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(A. E. S. McINTOSH, B.Sc., Ph.D.)

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REPORT OF THE GENETICIST FOR THE YEAR 1931–32

By

(A. E. S. McINTOSH, B.Sc., Ph.D.)

I. SUGAR CANE.

(I) INTRODUCTION.

The aim in the sugar cane breeding work is the production of sugar cane varieties suited to giving the highest possible returns of sugar per acre under the different conditions in which sugar cane is grown in Barbados. As a result of Departmental trials and experiments and of tonnage returns by planters, it is evident that no one variety is adequate either for all districts of the island or for all times of reaping during the crop season. Consequently, breeding and selecting are planned to cater for specific districts and times of reaping in crop.

From the plant breeder's point of view the immediate necessities in seedling production in Barbados are (1) increased weights, (2) retention of weight throughout crop, more particularly in the drier districts, (3) commercial resistance to gumming disease and (4) earlier juice ripening in the rainier districts. The Barbados varieties at present grown have excellent juice qualities and it is desirable through breeding to increase yielding capacity without loss of this juice quality. This is being attempted through two main schemes of breeding:— (1) crossing between Barbados varieties of different "lines" in descent (1) and (2) crossing Barbados "male" varieties of good juice-quality-endowing capabilities with imported Javan varieties and back crossing the best of the resulting crosses on to the same Barbados "male" varieties.

(II) SUGAR CANE BREEDING.

Sugar cane breeding was carried out at Lion Castle during October, November and December, 1931. The number of crosses was very greatly increased and attention could only be paid to routine pollen dusting operations and examinations of the extent of pollen production in varieties tried as parents for the first time; thus no continuation of last year's pollen studies could be made.

In all forty-one crosses were made. These are listed in Table I.

TABLE I.

SCHEDULE OF CROSSES MADE DURING BREEDING SEASON OF 1931.

"Female" Parent.	*"Male" Parent.*
Ba.11569	B.H.10(12), Ba.6032, B.417, .B.891, B.663, B.381, B.391, M.E.17*, B.(30)L7*, P.O.J.2714, P.O.J.2878, Co.281, Co.290.
Crosses of P.O.J.2364 x Barbados "male" varieties	One or more of the following:— B.H.10(12), B.391, B.891.
P.O.J.2364	B.606, B.891, B.H.10(12), B.465, B.374, B.663, B.726, B.605, B.417.
P.O.J.2725	B.H.10(12), B.891, B.417, Ba.6032.
P.O.J.2379	B.H.10(12), B.891.
Toledo	B.H.10(12), B.891, Ba.6032.

(1) See Agric. Jour., Dept. Sci. & Agric., Barbados, 1932, Vol. 1 No. 1 pp.3—17.

* Parents marked with asterisk are selections of first crosses between P.O.J.2364 and Barbados "male" varieties.

In addition to the above crosses two Java-Barbados crosses were selfed. In all cases crosses and selfs were made with the "female" parent arrows protected in arrow lanterns in order to ensure certainty of parentage.

(III) SEEDLING RAISING AND PLANTING OUT.

The fuzz was collected when dry, stripped, sunned and sown in boxes in the usual manner. The relative fertilities of the various crosses were established by estimating the mean number of seedlings germinating per box for all crosses sown. The germinations from crosses of Ba.11569 with P.O.J.2714, Co.281 and Co.290 were so poor that no pottings were made.

Seedlings were pricked out of the boxes into the pots and the latter placed in the cisterns. In all approximately twelve thousand were potted, including populations of seedlings from thirty-eight crosses and two selfings. The populations were kept distinct in the cisterns.

The seedlings were planted out into the field in April. As is customary, wherever the number of potted seedlings in any population was in excess of field requirements, then selection of the most vigorous plants was made (q.v. previous Annual Reports).

Two groups, each numbering approximately 3,000 seedlings, were planted for early and late selections at reaping in 1933. These were made up of thirty-five populations—thirty-four from crosses and one from a "self."

The "lay out" in the two groups is similar and is such as to render legitimate statistical comparisons between populations of different crosses. To this end the individuals in each group are placed at random in the seedling block.

It has been possible to eliminate several crosses from inclusion in the first year seedling trials, by virtue of their poor population performances for two years (q.v. later).

The plantings include populations of proved value and also trial populations. The former have been allocated large numbers and placed in the group (i.e. early or late) in which they appear, by past performance, to do relatively best. The latter are given a number, where possible, to try them on an adequate population size in both groups, but where this is impracticable the whole population is placed in one group.

These seedlings will be reaped in 1933, the early group in January, and the late group in May.

(IV) RESULTS OF REAPING FIRST YEAR SEEDLINGS—CODRINGTON, 1932.

These seedlings were bred in 1930 and planted out in April 1931. There were three thousand in the early group, reaped in January, and three thousand in the late group, reaped at the end of April.

The usual field data was ascertained for each seedling reaped, as also for those seedlings selected. Lists of the latter are presented in Table II.

TABLE II.

FIRST YEAR SEEDLINGS.—CODRINGTON 1932. LIST OF FIELD AND FINAL SELECTIONS.

(i) Early Group.

Cross	Number reaped.	Approx. % field selection.	Approx % final selection.
Ba.11569 x B.H.10(12)	653	9.0	2.76
„ x B.726	195	3.0	0.00
„ x B.606	198	14.5	1.50
„ x B.374	150	3.3	0.00
„ x B.391	392	5.6	0.75
„ x B.755	118	6.0	0.00
„ x B.891	405	2.5	0.75
„ x B.605	98	5.0	1.00
„ x B.417	200	7.0	2.00
P.O.J. 2364 x B.374	70	23.0	0.00
„ x B.391	100	14.0	0.00
„ x B.891	49	10.0	0.00
„ 2725 x B.H.10(12)	153	10.0	2.67
„ „ x B.391	153	5.9	2.67
„ „ x B.755	97	6.0	0.00

(ii) Late Group.

Cross.	Number reaped.	Approx % field selection.	Approx % final selection.
Ba.11569 x B.H.10(12)	600	5.0	0.8
„ x B.726	148	1.3	0.0
„ x B.606	176	4.0	1.7
„ x B.374	149	0.7	0.7
„ x B.391	342	2.7	0.9
„ x B.755	119	0.8	0.8
„ x B.891	351	0.3	0.3
„ x B.605	100	0.0	0.0
„ x B.417	198	5.0	1.0
„ x B.663	42	0.0	0.0
P.O.J.2364 x B.H.10(12)	79	21.3	6.3
„ x B.374	74	7.2	4.0
„ x B.391	97	12.0	1.0
„ x B.755	29	3.3	0.0
„ x B.891	52	6.0	2.0
„ 2725 x B.H.10(12	150	2.7	1.3
„ „ x B.417	55	13.0	1.8
„ „ x B.391	147	0.7	0.0

This table shows the relative contributions of crosses to field and, what is of immediate importance, to final selections.

In order to ascertain the relative value of different crosses and also to give an insight into their hereditary tendencies, the extent of development of economic characters is determined for each and every seedling in the populations of all crosses. For each feature in each and every population the mean and distribution around that mean is ascertained. The resulting means and distributions are then compared so that it is possible for example to state that under certain conditions a cross gives seedlings with many long thin canes, with good weights but poor juices. With the employment of many "male" parents in crossing with say, Ba.11569, we can find the relative influences of these "male" parents on the progeny. Thus we find that some "male" parents endow high juice qualities, others good weights and so on. From an examination of two seasons' data, it is seen that there is remarkable constancy in this respect. These analyses of the populations, an example of which was given in the 1930-31 Annual Report, are of immense value in guiding the breeding work.

While these analyses are invaluable guides to the breeding capabilities of parents, they have their limitations from the standpoint of the relative values of populations as media for selection of promising seedlings—the standpoint of immediate importance. To illustrate: the cross Ba.11569 x B.H.10(12) gave a population with a mean weight of 29.15 pounds per stool while Ba.11569 x B.606 gave a seedling population with a mean weight of 26.67 pounds. The difference of 2.48 pounds between means was significant, yet, while the former cross had only 1.35% of its population with weights over 65 pounds the latter had 5.50%. From the selector's point of view of producing individuals of good weights the latter is more valuable, although on the whole its seedlings tend to have lower weights.

This has led to the formulation of an additional set of tables for the important features (1) weight of stool and (2) per cent. sucrose in juice. An example is given in Table III.

TABLE III.

FIRST YEAR SEEDLINGS REAPED AT CODRINGTON, 1932.

Group — Late.
Feature — (i) Weight of Stool.
Percentage Occurrence of Seedlings 65 pounds and upwards.
Crosses in order of merit.

Cross.	Number reaped.	Number of 65 lb. and upward.	Percentage occurrence.
P.O.J.2364 x B.H.10(12)	71	13	18.31
„ x B.391 ..	87	12	13.79
„ x B.374 ..	67	7	10.45
„ x B.891 ..	47	4	8.51
P.O.J.2725 x B.417 ..	36	3	8.33
Ba.11569 x B.606 ..	144	8	5.55
P.O.J.2364 x B.755 ..	29	1	3.45
P.O.J.2725 x B.H.10(12)	126	4	3.18
Ba.11569 x B.417 ..	159	4	2.52
„ x B.374 ..	108	2	1.82
P.O.J.2725 x B.391 ..	108	2	1.82
Ba.11569 x B.H.10(12)	517	7	1.35
„ x B.391 ..	240	3	1.25
„ x B.755 ..	97	1	1.00
„ x B.891 ..	226	2	0.88
„ x B.605 ..	70	0	0.00
„ x B.663 ..	34	0	0.00
„ x B.726 ..	117	0	0.00
P.O.J.2725 x B.755 ..	84	0	0.00

It is hoped that by a systematic preparation and study of tables such as presented above in Tables II and III and by Tables of population analyses such as exampled in the 1930-31 Annual Report, and by a practical application of the findings, to improve the standard of the first year seedling block and so render the selection of its best seedlings increasingly promising.

Several crosses of P.O.J.2364 with Barbados "male" parents were of exceptionally good weight and appearance. They had, however, low sucrose percentages in their juices. These have been retained for back crossing purposes.

(V) RESULTS OF REAPING SECOND YEAR SEEDLINGS.

These seedlings were selected from the first year seedlings during the crop season of 1930. Approximately thirty seedlings were selected from each of early, medium and late cut seedlings. They were multiplied and prior to planting into second year trials in November 1930 minor selections were made in each group to leave in each approximately twenty seedlings.

Plants of each group were planted at Dodds (lower rainfall station) and Todds (higher rainfall station) ; the earlies, mediums and late to be reaped early, medium and late respectively at crop in 1932. At each station each time-of-reaping group was pitted against the standard plantation variety, or varieties which latter acted as standards for comparisons. Each seedling and standard was replicated in four randomised blocks of which the plots were twenty-four cane holes each (i.e. approximately 1/72 acre). From two years experience it is found that such lay-outs on the average require differences of approximately four tons per acre and 1% sucrose in juice between seedling means for statistical significance, so that they may be considered on the whole quite satisfactory.

The procedure adopted for selection purposes for each group at each station was the same. For each plot the following features were ascertained, (1) weight of canes (2) number of sound canes (3) number of rotten canes and (4) percentage sucrose in juice. The last figure was derived from eighty pound cane samples from each block.

During reaping continuous observations were made on cane habit and appearance, cleanliness of trashing, shooting at eyes and rooting at nodes, ease of cutting, arrowing and other features which affect the desirability of each seedling.

Statistical enquiries were made into (1) weight and (2) per cent. sucrose in juice.

Selections were based on all of the above. With increasing experience in this work the tendency is to make selection more severe.

The following selections for further trial were made and the recent scheme of numbering retained.

Group.	Variety.	Station.			
		Drier (lower tonnage)		Wetter (higher tonnage)	
		Early Reaping.	Late Reaping.	Early Reaping.	Late Reaping.
Early	B.3011	+*	+		
„	B.3013	+	+	+	+
Medium ..	B.3038		+		
Late	B.3063	+	+	+	+
„	B.3078	+	+	+	+

* A plus sign denotes that these selections will be given further trial under the condition or conditions noted.

These will be multiplied and tried out at those plantations representative of the climatic districts for which each was chosen.

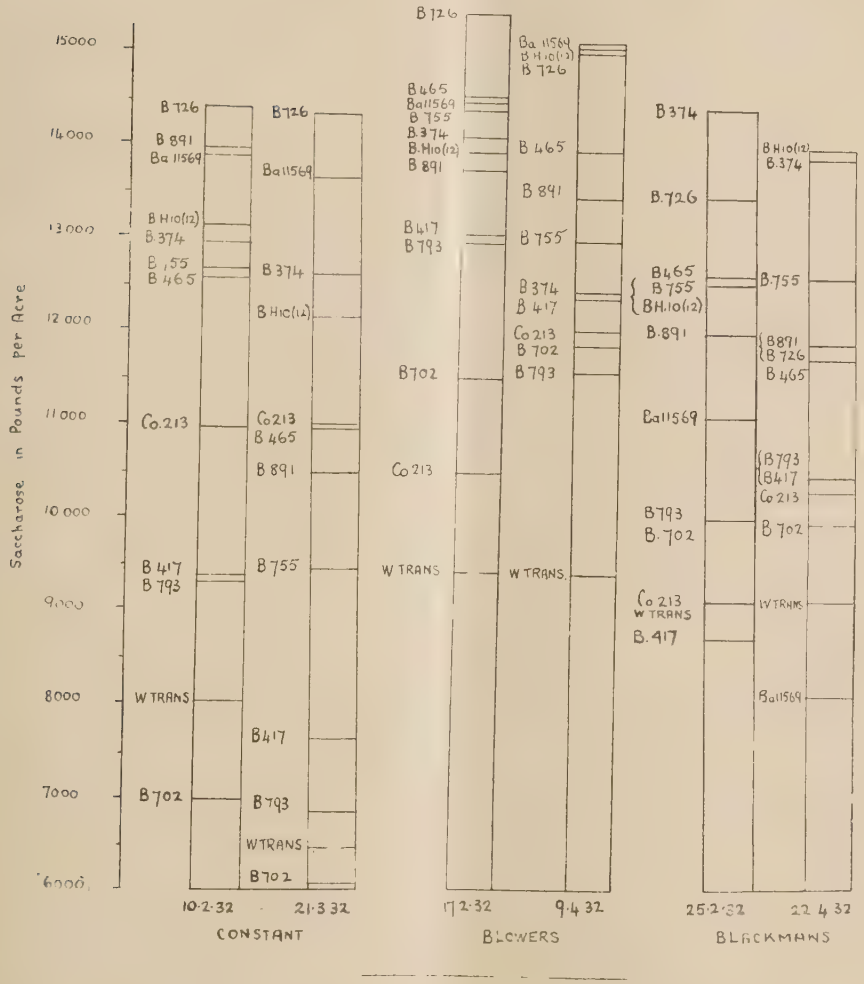
(VI) VARIETY TRIALS.

The new scheme of seedling breeding and selection trials commenced in 1928, and none of the seedlings produced and selected as yet have reached Variety

PLATE I

VARIETY TRIALS 1930-32 PLANT CANES.

FEATURE - YIELD OF SACCHAROSE IN POUNDS PER ACRE.



Trial stage. The most promising of the seedlings produced in years just prior to the commencement of the new system were absorbed into the latter, so that there has been an inevitable pause recently in the addition of seedlings to variety trials. The past four years have, so far as variety trials are concerned, been devoted to testing seedlings which had reached select variety stage prior to the new scheme of work and to a gradual elimination of the less promising of these and a repeated testing of the promising ones. The varieties B.726 and B.891 emerged during this period from Departmental trials to being planted on a commercial scale. During this transition period from the old to the new schemes of breeding and testing, the variety trials have also been treated in such a manner as to reveal the effects of "place" and time of reaping on the yield of varieties (see also "maturity" experiments) i.e. their saccharose per acre return, their tonnage per acre and the chemical composition of their canes. Much valuable data has been accumulated by this trial period as to the nature of these effects and their relative magnitudes and they have given suggestions for a more accurate type of trial and distribution of trials. They have conclusively shown that "place" and time of reaping affect varieties differently and have consequently revealed the necessity of breeding for and accurate trial and selection within as many stations representative of climatic and soil districts as is practicable. They also show that the number of seedlings reaching the variety trial stage should be reduced as far as possible by a series of strict seedling trials, so that those surviving to the variety trial stage should have been emphatically proved by then to show decided promise. Thus the number passing on to this final trial stage would for several years at least be limited and would constitute for any trial for a specific district and time of reaping a manageable number for which large trials and many trials could be run. It would be the purpose of the preliminary seedling trials and maturity experiments to decide on the "place" and time of reaping categories most suitable to seedlings passing into such district variety trials.

(VIA) VARIETY TRIALS 1930–32.

(1) PLANT CANES.

There were three plant cane stations, *i.e.*, Constant, Blowers and Blackmans. Twelve varieties were tried, viz., B.H.10(12), Ba.11569, B.726, B.381, B.755, B.374, B.417, B.465, B.793, B.702, White Transparent and Co.213. The last is a Coimbatore (India) seedling. At each station all varieties were randomised in each of eight blocks. The plots were sixty cane holes (approximately 1/30 acre). Each station had four blocks cut at each of two reapings i.e. an early and a late time in the crop for the districts in which the stations are situated.

The weight of canes and the sucrose percentage in juice were determined for each plot. One complete chemical analysis was made for each variety at each station and each reaping and the mean of the plot sucrose per cent. figures for each variety fitted into this complete analysis for purposes of computing the yield of saccharose per acre.

The results are presented in diagrammatic form on Plates I and II.

Discussion.

The dry season of 1930 continued up to the end of May, 1931, but there fol-

lowed six months of high and well distributed rainfall. This high rainfall was general throughout the Island and its results are seen in the tendency for yields to approximate at the three stations.

There is one point of considerable interest in the tonnages at Constant. Some varieties, *e.g.* B.726 and Ba.11569, retained their tonnages comparatively well up to second reaping while others, e.g., B.891, B.755 and B.417 dropped heavily. B.891 was second to B.726 at the early reaping in saccharose per acre return but at second reaping fell to a low position in the order of merit. Thus at Constant there is seen a marked differential response on the part of varieties as crop progresses. This severe drop in returns by some varieties, as seen at Constant, is by no means general for the island and goes to emphasize the necessity for trials which cater for districts and times of reaping.

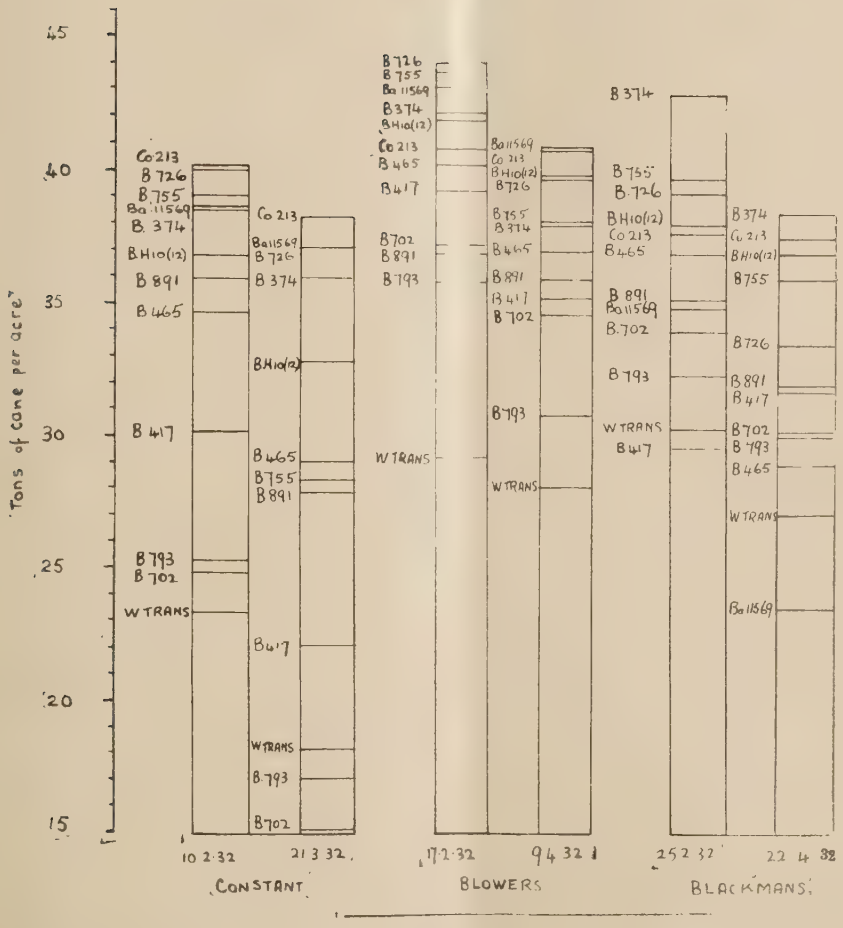
B.793 and B.702 performed very badly and will be discarded. White Transparent, which had been retained for purposes of assessing the effects on tonnages of the amount and distribution of the seasonal rainfall over many years will be discarded also from the trials. B.417 gave poor returns and with the prevailing rate of planting per acre, can never be expected to yield consistently well. With closer plantings it may improve to be of use in the drier districts, for it is a very vigorous growing variety but it is handicapped by poor tillering and consequently develops few canes. Co.213 gave very good tonnages but very poor juices. It retains its tonnages very well throughout crop (see also "maturity" experiments) and for this feature will be used as a variety for breeding purposes. As might be expected from such a variety, it performs relatively better in the drier districts. B.465 yielded rather well throughout, but it is essentially relatively at its best under conditions which are drier than experienced last year. Unfortunately, however, its leaves tend to show heavy symptoms of gumming disease, and although it might subsequently prove tolerant to this disease it would always act as an acute "carrier." At most it had previously shown promise for small areas in the drier districts and in view also of its susceptibility to the gumming diesase it will not be tested in the immediate future. B.755 gives good tonnages, but, for a Barbados variety possesses very poor juice qualities. It appears to yield consistently well, but never appears to excel and cannot, as a consequence for the present, be fitted into any particular district or time of reaping category. Its juice ripening seems to be checked comparatively early on in crop in the drier districts so that it improves poorly in this respect relative to most others. It appears to attain its optimum juice quality in the rainier districts towards end of crop, but here it is not so good as B.H.10(12). It cannot, for the present, be recommended for planting on an estate scale. The variety B.374 has yielded consistently well in those Departmental plant cane and ratoon trials which have been conducted in high tonnage areas, but it is unpopular with planters and factory managers owing to its variable returns and poor juice qualities. While the Department does not feel justified in recommending this variety for these areas, it is suggested that those who wish to plant it should arrange for it to be harvested around early mid-crop and should confine it to an experimental acreage until they have satisfied themselves further as to its capabilities.

This leaves four varieties i.e., B.H. 10 (12), Ba.11569, B.726 and B.891. The plantings of these four at present almost constitute the entire sugar cane acreage of the island. Repeated trials appear to show that they are consistently

PLATE II

VARIETY TRIALS 1930-32. PLANT CANES.

FEATURE YIELD OF CANES IN TONS PER ACRE.



good for certain environments and they certainly have performed best in the variety trials during the transitional period referred to in the introduction to this section

B.H.10 (12). This variety has gradually throughout the year since its liberation become restricted to those districts where it is best suited, *i.e.*, the rainier districts. But it is perhaps not yet fully realised that it is essentially a late ripening cane. It does not on the average attain a respectable juice quality until mid-crop and after this its juice continues to rise in these districts up to end of crop. It germinates excellently, ratoons well, is easily cut and does not rot readily. It is indeed admirably suited to the rainier districts for the second half of crop. It is, however, poorly suited to lower rainfall districts on account of the relatively slow development of its entire stools, which development is cut short in the drier districts by a shorter rainy season.

Ba.11569. This variety has suffered in popularity in the drier districts owing to its pronounced susceptibility to leaf infection and to a lesser degree stem infection with the organism of gumming disease. At one time, when, in the course of two years, severe leaf symptoms had spread from an area in St. Lucy and St. Peter to practically all places where it was grown and more especially when in 1931 considerable gum exudations were found in cut canes, it appeared as if this variety would collapse under the continued infections and more particularly when certain environmental conditions favoured the virulence of the organism. In view of this possibility the only course open was a recommendation to restrict the area planted to it, until the effects of the disease in time could be ascertained. Such a procedure was adopted for a time in other West Indian Islands with Ba. 11569 suffering from gumming disease. Observations have been made on the disease over this period and the advice of Mr. Ashby, of the Imperial Mycological Institute, was obtained. The writer also had the opportunity of seeing the ultimate effects of this disease on a susceptible variety in Porto Rico and of discussing the situation in Barbados with Mr. Bell who has a first hand knowledge of the disease from his work in Queensland. As a result, and to summarise, the situation in Barbados would appear to be as follows. Gumming disease is present in Barbados and is likely to remain for so long as the island is planted with varieties which are not commercially immune or highly resistant to infection; that with a prolonged planting of such latter types it is possible that the disease may be, through the nature of the organism, eventually eliminated; that good seedling production will be rendered more difficult, since elimination of highly susceptible types, although otherwise desirable, will have to be made; that varieties like Ba.11569 are highly susceptible to infection, yet probably commercially tolerant (i.e. do not appear to be affected in their yield of canes) and that they therefore will always act as acute "carriers"; that it is not impossible that such tolerance will break down under certain environmental conditions and unfavourable consequences result. In brief it appears that the rational course to adopt is to produce seedlings which on inoculation show commercial immunity or high resistance to the disease and to liberate only such kinds to estates.

In the drier districts Ba. 11569 has done very well and still continues to do well despite severe gumming infections. It commences growth slowly but does not suffer. comparatively, so much in the dry season as do other varieties. It quickly recovers with adequate rains and grows very rapidly and continues a good growth up to the end of the year. This capacity to recover and grow quick-

ly in the shorter favourable growing season of the drier districts makes it relatively best suited for such places. Here it gives good tonnages, average good sucrose per cent. in juice but has a marked tendency to lose weight and rot badly more particularly from mid-crop onwards. In districts of medium rainfall where tonnages tend on the average to be about 28 tons per acre or above, B.726 tends in general to better it. It appears to be best suited for early mid-crop and mid-crop reaping in the drier districts when its sucrose in the juice is reasonably good and before it commences to rot badly.

B.726. This variety is an excellent germinator. It grows well at first but is later especially susceptible to the water shortage towards the end of the dry season. Throughout its growing season it is easily affected by shortage of rainfall and is rather slow to recover under such checks. With well distributed rains, however, it grows very well indeed and gives high tonnages and excellent juices. It yields juice with comparatively high per cent. sucrose very early in crop and rapidly reaches its optimum, and more or less retains this throughout crop. Arrowing is scarce. Where it gives high tonnages it tends to be recumbent at crop and back roots heavily, but this does not appear to affect the quality of the canes. In drier districts it retains its tonnage relatively well during crop and in this respect is better than Ba.11569 and perhaps B.891. It is a very good ratooning variety in ratoon districts. Owing to its susceptibility to shortage of rainfall it were better planted on a restricted scale only in the drier districts. Its proportionate acreage may safely be increased as the average rainfall increases until characteristic B.H.10(12) areas are reached. Here it is suited by virtue of its early high juice qualities for planting for early reaping, both its plant canes being reaped before B.H.10(12) plant canes and its ratoons before B.H.10(12) ratoons. If planted in drier districts it appears to be better suited to late reaping than either Ba.11569 or B.891.

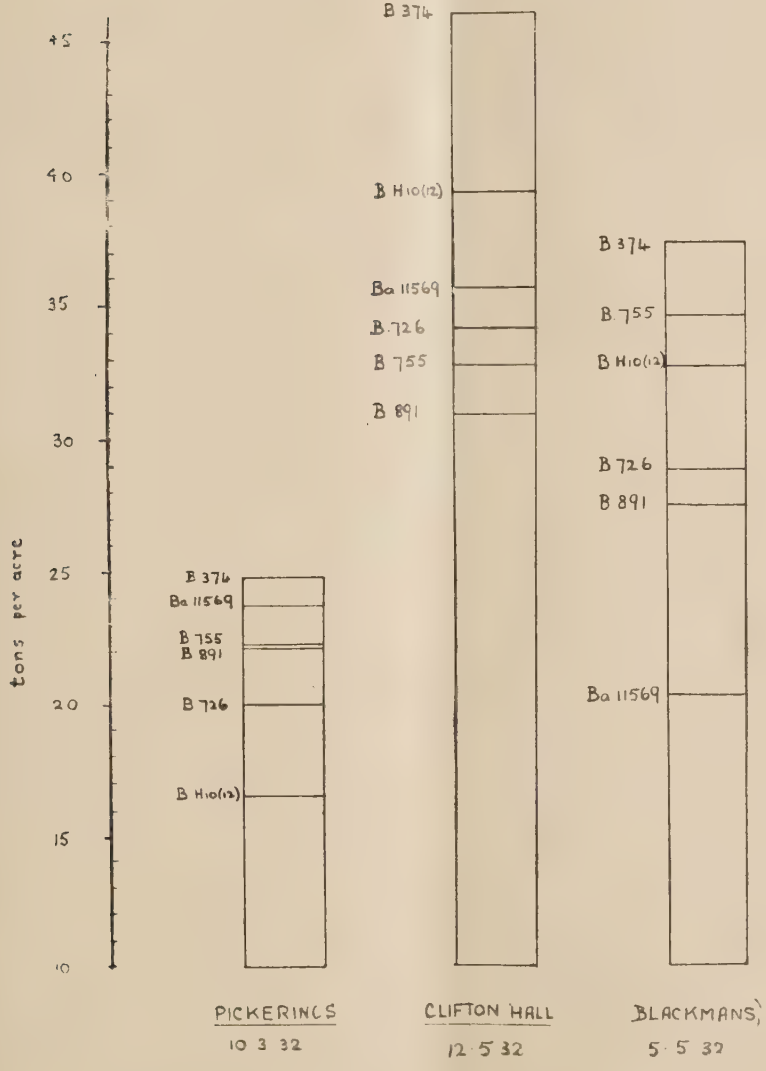
B.891. This variety appears to be relatively better suited for the first reapings in the drier and intermediate rainfall districts. It germinates on the average much the same as Ba.11569 and although not susceptible to drought during the growing season, yet it grows a little slower than the others. It produces many tillers and above the average number of canes. The juice is of excellent quality and reaches a relatively very high sucrose figure very early in crop. It is only slightly attacked by gumming disease and this is a great point in its favour.

It will be seen from the foregoing that the rainier and higher tonnage districts are well catered for with a combination of B.726 and B.H.10(12); also the districts of intermediate rainfall with B.891, B.726 and B.H.10(12. The problem for the drier and below average tonnage districts is unquestionably more difficult. In such districts if B.726 cannot be successfully grown, two varieties remain, *i.e.*, Ba.11569 and B.891 B.891 is essentially at its best at early to early mid-crop reaping while Ba.11569 appears to be best for early mid-crop and mid-crop. There is also always the uncertainty of the effects of gumming disease on Ba.11569 to contend with. At the moment there is no satisfactory variety for the second half of crop in the dry districts, and to remedy this through seedling production is the chief problem of the Department's sugar cane breeding and seedling selection work.

PLATE III.

SUGARCANE VARIETY TRIALS. 1930-32

FIRST RATOONS. - TONNAGE OF CANES PER ACRE



At present several seedlings in their initial stages of field trials have shown distinct promise in this respect, but no more can be said of them until they have been subjected to further and extended trials.

The 1930-32 variety trials conclude the series of trials over the transition period. Next crop season, seedlings from the new scheme will be reaped in variety trials.

(2) RATOONS.

Three ratoon stations were reaped in 1932, viz., Pickerings, Clifton Hall and Blackmans. There were ten varieties but eventually only six were reaped, *i.e.*, B.H.10(12), Ba.11569, B.374, B.726, B.755 and B.891. The plots were forty-two cane holes (approximately 1/40 acre) and all varieties were randomised in each of eight blocks at each station. Eight blocks were reaped at Pickerings and seven at Clifton Hall and Blackmans. Computed tonnages were ascertained for each variety at each station. These are presented in Plate III.

A survey of the results of ratoon trials for three years leads to the following conclusions. For the essentially ratooning districts (*i.e.*, high rainfall districts) B.H.10(12), B.726 and B.374 have given consistently good results. In the few ratoon trials which have been tried in intermediate rainfall districts Ba.11569 has done well. B.891 has had very few trials under such conditions and it would be premature to make conclusions about its performance.

(VII) MATURITY EXPERIMENTS.

The object and "lay cuts" employed in these experiments have been detailed in previous Reports.

This season the following varieties were included:—B.H.10(12), Ba.11569, B.374, B.381, B.417, B.465, B.605, B.693, B.726, B.755, B.891, P.O.J.'s 36, 213, 2354, 2725, and Co.213.

At each of the two "places" employed, Graeme Hall and Vaucluse, three reapings were made in crop, viz., early, medium and late. For each plot the following features were noted: (1) weight of sound canes (2) number of sound canes (3) number of rotten canes and (4) percentage sucrose in the juice.

The spacing at Greame Hall was 6′ x 6′ and at Vaucluse 5′ x 5′.

RESULTS—ALL VARIETIES.

Features.	Graeme Hall.				Vaucluse.			
	Reaping.				Reaping.			
	1	2	3	Av'ge	1	2	3	Av'ge
Tons per acre	29.04	26.04	22.92	26.00	34.79	33.26	28.51	32.19
Percentage loss in tonnage	—	10.3	21.1	—	—	4.4	18.1	—
Percentage rotten canes..	5.61	9.57	15.60	10.26	12.85	15.12	19.21	15.73
Weight of sound single cane (lb)	3.74	3.99	3.84	3.86	4.42	4.52	4.50	4.48
Per cent. sucrose in juice	15.70	18.94	19.56	18.07	14.88	16.85	17.73	16.49
Number of canes per acre				18,336				21,852

There was a higher average tonnage at Vaucluse than at Graeme Hall. This is due to the higher number of canes per acre and the greater weights of these individual canes. Actually there were more canes per stool at Graeme Hall than at Vaucluse but the increased number per stool was more than offset by the fewer number of stools per acre and the lighter weight of the individual canes.

There is a loss of tonnage throughout the crop at both places. This is slightly greater at Greame Hall than at Vaucluse. The greatest drop at Vaucluse is between second and third reaping while there is a steady drop at Greame Hall.

The weights of the individual sound canes remain comparatively constant throughout crop. There is only a slight tendency for these weights to rise to mid-crop then to drop as the late reaping approaches.

The percentage of rotten canes rises throughout the reapings at both places and at both there is a higher rise between second and third than between first and second reapings. The percentage sucrose in juice rises throughout at both places. Juices mature more readily at Graeme Hall.

It is seen that both "place" of growing and time of reaping exercise great effects on the tonnages and the juice qualities. In these experiments time of reaping was as important as "place" so far as tonnages were concerned. The difference between the mean tonnages of all reapings between the two "places" was six tons, while the difference between early and late reapings at both "places" was also six tons. So far as sucrose in juice is concerned the difference between the variety means at the three reapings was greater than the difference between the "place" averages.

From the above it is apparent that for each "place" there is an optimum period in crop when saccharose returns per acre are at their best. There is also the pronounced influence of "place" on the tonnage and juice quality. Finally the optimum time for reaping is different at both "places".

The "place" effect is chiefly due to the amount and distribution of the rainfall and to the difference in soil texture, composition and depth.

Different responses of varieties to these effects have been observed in numerous experiments and these differences vary with the different conditions.

These responses by varieties to the two "places" and three reaping times of these maturity experiments cannot be presented in detail here, but a few outstanding examples will be given. Of the imported varieties tried Co.213, P.O.J.36 P.O.J.213 and P.O.J.2354 retain their tonnage extremely well. The occurrence of rotten canes is very low indeed throughout crop. This is so at both "places". P.O.J.2725 on the other hand loses tonnage by an increasing rot in canes throughout crop. Among the Barbados varieties loss in tonnage is very prevalent over all varieties through the crop. Some however are more pronounced in this respect than others, *e.g.* B.381 and B.465, while B.H.10(12) and B.726 are much less detrimentally affected by the progress of time in crop.

Varying responses by varieties in sucrose formation also occur.

The consideration of the results of the maturity experiments is supported by those of the previous two years and points to the necessity for studying the relative performances of varieties at varying "places" and times of reaping in crop in order to select a combination of varieties best suited for each. This point has already been referred to in the introduction to Variety Trials.

(VIII.) GROWTH RECORDING.

Growth records over fortnightly periods have been carried out at Graeme Hall and Vaucluse for several varieties over the past three years. They constitute an extended investigation and will be reported in detail in future in a separate publication.

II. SWEET POTATO.

(I) VARIETY TRIALS.

(a) SWEET POTATO "CATCH" CROP TRIAL, 1931.

Object. The object of this trial is to improve on the existing commercial "catch" crop varieties by the introduction of varieties or by the selection of seedlings produced by the Department. It is hoped to select through trials, varieties which possess the following features:—

(1) high yield in a short growing period;

(2) good eating qualities;

(3) good storage qualities;

(4) suitability for export.

The varieties at present grown in "catch" crops in the island are lacking in one or more of the above features.

Trials. The "catch" crop trial of 1931 was planted at Codrington Experi-

mental Station on the 8th and 9th July and dug on the 6th November—in all a growing period of approximately seventeen weeks.

The varieties tested were recruited from three sources, viz:

(1) selected seedlings

(2) varieties, both local and introduced: (a) previously tested; (b) tested for the first time.

There were eleven selected seedlings. These were selections made from a yield and cooking trial of thirty second year seedlings (see pages 51 and 52 of the Report of the Department of Science and Agriculture, Barbados 1930-31).

The new introduced varieties tested consisted of two varieties from Mauritius and Pumpkin Yam from the United States of America.

The remaining varieties had been tested previously in the sweet potato trials, but were re-included on grounds (1) of their serving as the standard local varieties used for "catch" cropping purposes, Six Weeks and Red Nut (2) of their being previously tested and proving sufficiently good to justify further trial—V.52, Caroline Lea, Brooks Gem, Brooks Seedling, No. 3 Brooks Seedling No. 29, (3) of their being previously but insufficiently tested, Philippine Seedlings Nos. 1, 2 and 3.

There were twenty-four kinds to be tested. The field trial was divided into two lots of fourteen varieties each. Four varieties occurred in both lots. These four comprised the local standards, Six Weeks and Red Nut, and two promising introduced varieties, V.52 and Brook's Seedling No. 3. The two subdivisions of the trial were planted alongside one another. The fourteen varieties in each were distributed at random in each of four blocks. The area of the plot was forty-two cane holes (approximately 1/40 acre). Slips were planted in three hills per cane hole.

Results. The potatoes were dug on the 6th November. At digging the following features were noted for each plot:—

A. *Vines.*
(1) Habit
(2) Weight.

B. *Potatoes.*
(3) Mode of bearing
(4) Depth of bearing
(5) Size uniformity
(6) Shape uniformity
(7) Number
(8) Weight in pounds
(9) Number of "scarabeed" potatoes.
(10) Weight of "scarabeed" potatoes.

All features, with the exception of weight of potatoes, are kept for reference for descriptions of varieties. The yields of potatoes in the two trials are presented in the following table in which the varieties are listed in order of yield merit, and computations of yield per hole and yield per acre are presented.

TABLE I.

SWEET POTATO "CATCH" CROP TRIAL—CODRINGTON EXPERIMENT STATION. JULY–NOVEMBER, 1931.

Variety Yields of Potatoes From Both Trials Listed in Order of Merit.

Symbol.	Name of Variety.	Source of Variety.	Mean Yield of Potatoes per Plot. lb.	Computed.	
				Yield per hole lb.	Yield. per acre lb.*
C(s)128 ..	Barbados Seedling No. 5	Barbados.	406.3	9.6	16,861
C(s)141 ..	„ „ 6	„	371.8	8.8	15,430
C(s)372 ..	„ „ 9	„	330.3	8.0	13,707
C(s)457..	„ „ 10	„	325.2	7.7	13,469
C(s)305 ..	„ „ 7	„	316.8	7.5	13,147
B(s) 69 ..	„ „ 1	„	316.7	7.5	13,140
C(s) 15 ..	„ „ 2	„	287.4	6.9	11,927
P.23 ..	V.52 ..	St. Vincent.	280.3	6.7	11,671
H(s)10 ..	Barbados Seedling No. 11	Barbados.	273.0	6.5	11,330
P.1 ..	Six Weeks ..	„	258.1	6.1	10,626
P.32 ..	Mauritius No. 1	Mauritius.	251.5	6.0	10,437
C(s)94 ..	Barbados Seedling No. 4	Barbados.	248.0	5.9	10,292
C(s)323..	„ „ 8	„	231.0	5.5	9,587
C(s)35 ..	„ „ 3	„	229.0	5.5	9,504
P.22 ..	Brook's Seedling No. 3	Queensland.	221.9	5.3	9,233
P. 3 ..	Red Nut ..	Barbados.	217.5	5.2	9,058
P.30 ..	Philippine No. 3	Philippines.	216.6	5.1	8,989
P.29 ..	Philippine No. 2	„	197.3	4.7	8,188
P.6 ..	Caroline Lea ..	Barbados.	194.3	4.6	8,063
P.20 ..	Brook's Seedling No. 29	Queensland.	182.2	4.3	7,561
P.18 ..	Brook's Gem ..	„	176.3	4.2	7,316
P.28 ..	Philippine No. 1	Philippines.	176.0	4.2	7,304
P.33 ..	Mauritius No. 2	Mauritius.	92.2	2.2	3,826
P.31 ..	Pumpkin Yam	U.S.A.	73.8	1.7	3,063

* Statistical note. A difference of 2,900 pounds per acre or more between variety yields may be regarded as a significant one.

Cooking Test. Four average potatoes of each variety in the trials were selected, given a number, and sent to various persons for a report on their qualities when cooked. The number of independent judgments on any one potato varied from three to twelve.

The criticisms returned varied considerably for each potato and in six cases only could they be said to agree.

These reports will, however, be retained as contributory evidence in future trials with these varieties.

The yield returns, as summarised in the table, reveal points of interest.

The potato varieties from the Philippines do not appear to yield well in Barbados. The two varieties from Mauritius were tried for the first time. One, named here Mauritius No. 1, appears to yield quite well, whereas Mauritius No. 2, is definitely poor in this trial. Both, however, are being tried again in the "long" crop trial. Again Brook's Seedling No. 3 has given the highest yield of the three Brooks' seedlings grown. Reports on its cooking qualities are however unfavourable. Six Weeks has again yielded highest among the local standard varieties. This variety, however, although cooking well, appears to keep badly. The St. Vincent potato—V.52—has again yielded well and is promising.

The Barbados seedlings, bred in 1928 and selected since then and tried in a variety trial for the first time have yielded very well, indeed, and will form the subject of further investigation.

(b) SWEET POTATO "LONG" CROP TRIAL.

The object of this trial is to obtain the best available potato varieties for planting over a long crop season which may extend on the average from September, October or November into the dry season months.

The trial was planted at Ashbury plantation in November 1931 and potatoes were dug at the end of May 1932, in all a growing season of approximately twenty-nine weeks. There were thirty-six varieties tried. There were sixteen Barbados seedlings, grown and selected under "long" crop conditions since 1929, and ten varieties. The latter included two local varieties, Trinidadian (Black Rock) and Red Nut, three Queensland varieties, one St. Vincent, two Mauritius, one Philippine and one from the United States of America.

All were randomised in thirty cane hole plots (*i.e.* approximately 1/60 acre) in each of four blocks. Plantings were made as usual, i.e. three hills per cane hole.

At digging, similar data as in the "catch" crop trial was taken.

The yields are presented in Table II.

TABLE II.

SWEET POTATO "LONG" CROP TRIAL—ASHBURY, 1931—32.

Yield of Varieties.

Variety or Seedling Symbol.	Name	Source	Mean yield per plot – lb	Statistical Note
B (s) 24	Barbados seedling.	Barbados.	266.0	There was a significant effect of varieties on yield variance. A difference of ± 47.6 lb between the mean variety plot yields may be regarded as significant.
P 22	Brook's seedling No 3.	Queensland.	253.0	
B 3	Barbados seedling	Barbados.	229 0	
B 5	,,	,,	228.8	
B (s) 117	,,	,,	228.5	
P 23	V. 12.	St. Vincent.	223.5	
B 11	Barbados seedling.	Barbados	216.5	
C (s) 257	,,	,,	216.5	
P 3	Red Nut.	,,	216.5	
B 9	Barbados seedling.	,,	199.5	
P 2	Trinidadian.	,,	198.5	
B 6	Barbados seedling.	,,	191.5	
B 7	,,	,,	191.0	
B 8	,,	,,	186.3	
B 1	,,	,,	181.3	
P 33	Mauritius No 2.	Mauritius	177.8	
B (s) 294	Barbados seedling.	Barbados	166.3	
H (s) 7	,,	,,	166.0	
B 2	,,	,,	161.0	
A (s) 44	,,	,,	160.0	
G (s) 9	,,	,,	159.8	
B 4	,,	,,	159.8	
C (s) 17	,,	,,	149.0	
P 28	Philippine No. 1.	Philippines.	147.5	
P 32	Mauritius No. 1.	Mauritius.	146.0	
C (s) 382	Barbados seedling.	Barbados	138.3	
B (s) 219	Barbados seedling.	Barbados	130.5	
B 10	,,	,,	128.8	
C (s) 364	,,	,,	128.8	
C (s) 366	,,	,,	128.5	
C (s) 68	,,	,,	124 0	
Y (s) 26	,,	,,	123.3	
P 18	Brook's Gem	Queensland	121.3	
Y (s) 13	Barbados seedling.	Barbados	108.0	
P 20	Brook's seedling No. 29.	Queensland.	106.0	

Cooking tests of the most promising were made.

As a result of field selections the following have been retained for the next "long" crop trial:—P.22, P.23, P.33, B(s)24, C(s)257, G(s)9, B.11, B(s)177 and B.3.

III. COTTON.

(I) COTTON SPACING EXPERIMENT.

This experiment was essentially a repetition of the one carried out last year, so that the details of the experimental technique will not be repeated.

Its object was to test the effect of two spacing distances on the yield and time of yield of seed cotton. The spacings employed were (1) rows 5′ apart, two plants at every 20″ in the rows and (2) two rows 2′ apart, space of 3′; then two rows 2′ apart etc: two plants at every 20″ in the rows.

The cotton was sown in September 1931 and picked as it matured during January—March 1932.

For purposes of assessing the effect of spacing on the time of yield the picking period was divided into three time periods. Thus:—

1st 13th January—25th January.
2nd 1st February—12th February.
3rd 18th February—7th March.

The computed yield of cotton per acre in both spacings shows a yield of seed cotton per acre of approximately half of last season's return in the experiment. This drop was due to the heavy rains during the first three months of growth.

An analysis of the yields from both spacings shows the double spacing—i.e. (2) above—to outyield the single by 19%. This increase was statistically significant. It is greater than the increase of the previous season's experiment—12%—by 7%. This is probably a result of conditions being such as to promote smaller trees this season.

The effect of spacing on time of yield of seed cotton, while pronounced in the previous season's experiment was almost negligible this season. This is seen in the figures below.

Yield—lb. Seed Cotton (In Experimental Plots.)

Period	Single Spacing		Double Spacing	
	Yield lb.	Yield as % total	Yield lb.	Yield as % total
1st	94.65	35.78	116.44	36.86
2nd	135.20	51.14	163.01	51.61
3rd	34.56	13.08	36.41	11.53
Total	264.41	100.00	315.86	100.00

The conclusions from those experiments are that the closer spacing increases the yield of seed cotton per acre, and that in a year favouring the cotton crop the closer spacing hastens the maturity of the crop. The importance of both those features is evident.

Some Aspects of the Flora of Barbados.

BY

F. HARDY, M.A., Dip. Agric.

(Continued from last issue).

3RD INSTALMENT.

THE MESOPHYTE ASSOCIATIONS OF BARBADOS.

CHAPTER X.

(A) MESOPHYTES OF GULLIES.

The vegetation of a typical gully [other than the epiphytic vegetation (xerophytic lithophytes) of the vertical gully wall described in the last chapter] will now be considered. According to the scheme of classifying the different regions of a gully under five headings, it would be advisable to describe the regions designated there as "the gully floor"; "the sloping gully sides"; "the stationary talus slopes"; and the "caverns" separately and in turn.

(II) PLANTS OF THE GULLY FLOOR.

The sorts of habitats presented by the different regions along the bottom of a gully are far too numerous to classify satisfactorily. A few general statements may be made, however, regarding the extreme conditions that occur there. First of all, the atmospheric conditions in the gullies are different from those of other localities. The air is more stationary in them than over the fields above. One notices in a gully an oppressive heat which is not evident on the open land, because of the persistent trade-wind. The almost entire absence of movement in the air of a gully, combined with the generally moist state of the soil, causes the humidity of the gully atmosphere to be considerably higher than that of the open fields. Secondly, the light conditions in a gully are very variable. In certain places along the gully floor, the sun's rays beat down uninterruptedly on to the growing plants, but in other places, the gully floor plants are protected from the direct rays of the sun either by taller plants, or by overhanging rocks. Extreme shade occurs in the caverns, which will be considered separately.

Regarding the soil conditions in gullies, we recognise at once numerous variations from the normal conditions. These are impressed by the differences in depth of the soil, and in the varying supply of water. In certain places, for instance, the bare rocky floor of the gully protrudes through the soil. In other places, deep pockets of rich, moist soil occur, and yet in others, the substratum consists of loose stones more or less surrounded and covered with soil.

These localities of loose stones gradate into the talus slopes which form a more or less distinct regional division of a typical gully. Here and there in a gully floor marshes occur, and very occasionally, running or stagnant water.

When one considers that all these kinds of habitats occur along the base of a gully of no very great extent, and that they merge imperceptibly one into the other, one is not surprised to find that the plants of a gully floor are very varied, and include many distinct types frequently growing in close proximity. One sees there few trees, however, but the profusion of shrubs, herbs, climbers and creepers is often very striking, reminding one of the plant-life in typical moist tropical districts such as occur in Trinidad, and certain other of the West Indian Islands. The following examples will serve to indicate the range of varieties in the plants of gully floors.

(a) Trees of the Gully Floor.

Chlorophora tinctoria (Fustic); *Citharexylum quadrangulare* (Fiddle Wood); *Hura crepitans* (Sandbox); *Sapium aucuparium* (Poison Tree); *Eriodendron anfractuosum* (Silk Cotton); *Haematoxylon campechianum* (Logwood); *Acrocomia sclerocarpa* (Macaw Palm), and various cultivated gully trees, which are nowadays mostly in a state of neglect. The chief of these are *Citrus* spp.; *Spondias spp.* (Plums); *Anona spp.* (Sugar Apple), (Sour Sop); occasionally *Myristica fragrans* (Nutmeg); *Coffea arabica* (Coffee), and *Pimenta acris* (Bay Tree).

(b) Shrubs of the Gully Floor.

Of those already mentioned as belonging to other habitats, *Caesalpinia crista* (similar to Horse Nicker in appearance); *Clerodendron aculeatum* (Wild Coffee); *Pluchea odorata* (Cure-for-All); *Solanum igneum* (Bitter Berry); *Tecoma stans* (Shrubby Yellow Bignonia); and *Psidium guajava* (Guava) may be noted. The following shrubby plants are quite common and conspicuous either by reason of their showy flowers or their striking foliage.

Foremost amongst them are certain Rubiaceous plants, such as *Gonzales spicata; Psychotria undata, Faranaea odoratissima, Chiococca racemosa, Guettarda scabra, Chomelia fasciculata, Randia aculeata,* and *Ixora parviflora;*—all of which possess smooth, unindented, opposite leaves, of more or less oval shape and spiky or loose racemes of odorous white flowers, which are followed in most cases by small, yellow, red or purple berries. These plants are especially found in moist shady spots in gullies, and are seldom seen elsewhere.

The Acanthaceous *Thyrsacanthus nitidus* (so common in the undergrowth of Turner's Hall Wood), and the Melastomaceous *Miconia laevigata* (with its characteristically net-veined leaves) also deserve note. Other species of Melastomaceae besides the last named occur occasionally, together with many large-leaved plants of the genus *Solanum*, and certain species of the spreading small-leaved Myrtaceous genus, *Eugenia*. Of interest is the rare occurrence of the tall grass, *Bambusa* (Bamboo).

Finally, many shrubby plants common as weeds of pastures and roadsides, are found growing in the dry and exposed places on the gully floor. Practically

all those plants of this category named in any of the plant-lists to follow, may be seen growing in the varied habitats of Barbados gullies.

(c) Erect Herbs of the Gully Floor.

These also are very numerous and varied. They include almost all those mentioned in connection with other habitats, such as rocky land, pastures, wayssides and waste places.

(d) Creeping Herbs of the Gully Floor.

Here again, most of the prostrate plants of certain other habitats grow in profusion amongst the other gully plants. Leguminous and Euphorbiaceous creepers are especially abundant in gullies.

(e) Climbing Herbs of Gullies.

These are generally rooted in the soil of the gully floor, but occasionally they may be found growing from pockets in the rocky wall. They climb up the aerial roots of the epiphytes or up the stems of the erect trees, shrubs and herbs. When in flower, they form a characteristic feature of the flora of a gully.

The climbers of Barbados gullies may be classified into twining plants and tendril climbers.

The *twining plants* twist in a spiral manner up their supports, and have long slender stems, with leaves relatively far apart. The leaves are usually displayed so as to prevent mutual shading, and their surfaces are placed at right angles to the rays of light. The *tendril climbers* have slender outgrowths (tendrils) which are sensitive to contact. The tendrils may be modified stems, leaves or inflorescence-axes (peduncles). The vegetative characteristics of tendril climbers are otherwise similar to those of twiners.

Twiners:

Convolvulaceae.

1. *Ipomaea sideafolia.* Christmas Wreath.
   A large quick-growing plant, resembling somewhat a sweet potato vine. The flowers are fairly large, and of a white or purple colour. They are borne in cymes. The leaves are cordate in shape, and of length about 3 inches.

2. *I. umbellata.* Hog Vine.
   A large plant with clusters (umbels) of bright yellow flowers, each of diameter 1 inch. The leaves are cordate, and of length about 2 inches. The numerous fruits are pale-brown, brittle capsules.

3. *I. sinuata.* Noyeau Vine.
   A large plant with white flowers each of diameter 1½ inches. The leaves are deeply divided, usually into 5 lobes.

4. *I. pentaphylla.*

This plant is characterised by its hairy stems and leaf-stalks. The hairs are long, soft and yellow in colour. The flower is white, and of diameter ¾ to 1 inch. The leaves are deeply divided each into 5 pointed, elliptical lobes, and are of length about 2½ inches.

5. *Jacquemontia pentantha=Convolvulus pentanthus.*
A slender plant of quick growth. The flowers are pale blue in colour, and are borne in groups of 3 or more in the axils of the small cordate leaves.

Other Families:

6. *Abrus precatorius.* (Leguminoseae,—Papilionatae) Crab's eye Vine.
This plant has slender branched stems, which are woody at the base, and which bear pinnate leaves consisting of 10 to 12 pairs of small oblong leaflets. The flowers are borne in racemes at the ends of leafless branches. They are small and of a pale purple colour. The fruit is an oblong woody pod of length about 2 inches. It dehisces on the plant and exhibits its scarlet seeds, each of which has a black spot at the base.

7. *Clitoria ternatea.* (Leguminoseae,—Papilionatae) Blue Vine.
A slender plant, with pale-green pinnate leaves, each of 5 fairly large leaflets. The flowers are axillary and solitary. They are of a bright blue (or sometimes white) colour, and have a recurved and flat round standard. The fruit is a narrow legume of length about 4 inches.

8. *Thunbergia fragrans.* (Acanthaceae).
A slender twiner with lanceolate leaves each of length about 2½ inches. The flowers are axillary, solitary, white, sweet smelling, tubular, with flat corollae of diameter 1 inch. The fruit is a beaked capsule containing 2 to 4 seeds.

9. *Tragia volubilis.* (Euphorbiaceae) Vine Nettle.
A long twining plant with woody base. The leaves are lanceolate, 2 inches long, and serrated along their margins. The male flowers are tiny, and are borne in small many-flowered racemes. The female flowers are solitary and axillary. The fruit is a capsule. The leaves, stems and capsules are covered with short fine stinging hairs.

Tendril Climbers:

(*a*) *Possessing tendrils which are modified stem-branches* (i.e. borne in axils of leaves.)

Passiflora foetida. (Passifloraceae) Love-in-a-Mist.
A slender hairy climber, with 3-lobed leaves of length about 3 inches,

and flowers (similar to the Passion Flower or to that of the Water Lemon), of diameter 1 inch. The fruit is a small berry, surrounded by a net-like envelope of green threads. The tendrils are borne in the same axils as the flowers.

(*b*) *Possessing tendrils which are modified leaves.* (i.e. borne on the stems opposite to leaves, and often bearing stems or flowering shoots in their axils.)

(1) *Momordica charantia* (Cucurbitaceae) Cerassee.

A slender plant, with deeply divided leaves. The flowers are either male or female. They are of a yellow colour and fairly large. The female give rise to conical, orange-coloured berries, which contain numerous flat, bright, red seeds. The fruit is about 2½ inches long, and is covered with short tubercles. The tendrils are twisted up in narrow coils.

(2) *Peponia* sp. (Cucurbitaceae) Wild Cucumber.

A slender climber with 5-lobed, pointed leaves of average length 2 inches. The flowers (male and female) are white. The fruit is an ellipsoidal green berry, turning red when ripe. It has pinkish pulp which smells similar to cucumber. Its length is 2 inches. The tendrils are coiled.

(3) *Smilax* sp. (Liliaceae) Wild Sarsaparilla.

A tall climber, armed with small prickles, and bearing sub-cordate leaves of average length 4 inches. The leaf has 3 to 5 longitudinal nerves, and bears two tendrils at its base, so that they may be said to be modified leaf-stipules. The flowers are tiny, and are borne in axillary groups. The fruit is a spherical berry (green when young and black when ripe) of diameter about ¼ inch. It contains 2 or 3 seeds.

(*c*) *Possessing tendrils which are modified inflorescence axes.* (Peduncles.)

1. *Vitis* (=*Cissus*) *sicyoides* (Vitaceae) Poison Withe or Scratch Withe.

A high climber, with stiff stems and numerous cordate leaves of length about 3 inches. The flowers are very small and are borne in flat forked pink umbels, which form a very conspicuous part of the vine. The fruit is a small black berry, which is eaten by birds, its seeds being thus spread by them.

2. *Serjania nodosa*=*Paullinia curuva* (Sapindaceae) Bastard Supple Jack or Sucking Bottle.

A tough woody liane with angular flexible stems and petiolate leaves. The leaves are trifoliate, each leaflet being elliptical and pointed, and of length about 3 inches. The petioles are winged. The tendrils come out opposite to the leaves, and are coiled like a watch spring (i.e flat spiral). Occasionally they occur in the leaf axils. The flowers are small, and are borne in small axillary groups. The fruit is a pear-shaped capsule, containing 1 to 3 black seeds.

3. *Cardiospermum halicacabum* (Sapindaceae) Wild Parsley or Heart Seed. A slender herbaceous vine, with deeply incised serrated leaves, each of length 1½ inches. The small flowers are borne in axillary groups, the axes of which also bear at their summits 2 thread-like tendrils each. The fruit is a green, bladder-like, 3 winged capsule, diameter ¾ inch, which contains three deep-purple spherical seeds. Each seed has a small white heart-shaped mark at its place of attachment.

(III) PLANTS OF THE SLOPING GULLY SIDES.

In those parts of a gully where one or both sides of the ravine slope upward more or less steeply toward the vertical gully-wall (which may or may not be very prominent in those places), the vegetation is of a different type from that of the moist gully floor. The conditions of growth, (due chiefly to the nature of the substratum and to the drainage of the soil), are such that typical mesophytes cannot thrive, and the community of plants developed on the slopes resembles more the rocky land type than that of the gully floor. In many places, bare rock is exposed on the slopes; in others, the soil is very shallow, and is liable to be washed down by rain. The conditions of light are strong, and altogether the growth of plants, other than those of a xerophytic nature, is almost prohibited.

The common plants growing on gully slopes are grasses (such as Sour Grass and certain other more or less prostrate forms); the rocky land plants *Lantana camara* (Red-flowered Sage), *Cordia cylindristachya* (Black Sage); *Lantana involucrata* (White Sage); and the shrubby *Pluchea odorata* (Cure-for-All); and finally, a few hardy mesophytes such as *Cassia polyadena* (Wild Tamarind); *Stachytarpheta indica* (Vervain); *Corchorus siliqulosus* (Broom Weed); *Synedrella nodiflora* (Porter Bush); *Desmodium incanum* (Sweetheart); the prostrate, daisy like *Wedelia gracilis; Euphorbia heterophylla* (Red Milkweed); the slender, twining, pale-blue flowered *Jacquemontia pentantha;* the shrubby Melastomaceous *Miconia laevigata,* and the feathery *Pilea microphylla,* which hangs in tress-like masses from the moister surfaces of the projecting rocks. These mesophytes are also fairly common on the loose talus slopes next to be described.

(IV) PLANTS OF THE STATIONARY TALUS SLOPES.

Gully talus slopes consist of fragments of rock detached from the gully wall, or washed down from the land at the top of the gully, mixed with a certain amount of soil. The soil has accumulated by the weathering of rock fragments, and by the decay of the plants, or by transportation of soil from the land at the top of the gully by rivulets of rain water started during the wet season.

The soil conditions of gully talus slopes are therefore peculiar. Usually the stones are not covered with soil, so that those plants which are found growing on the talus are rooted in the scanty soil which occurs in the interstices between the stones. The water supply of these plants is precarious; on the whole, it is scant, since the drainage of the talus is quick and exhaustive. The only reliable source of water is that which is held in the soil between the rock fragments, and this is liable to fail during dry weather, especially on talus slopes in those parts of the gully that are exposed to the direct rays of the sun.

The vegetation of gully talus slopes is somewhat similar to that of sloping gully sides. It consists chiefly of prostrate creeping plants which possess exten-

sive perennating root-systems that ramify between the stones. Foremost amongst them are certain grasses such as the broad-leaved pink-tipped, *Paspalum fimbriatum*, along with *Sporobolus indicus* (Pipe Grass) and species of *Panicum*. An interesting carpet plant of frequent occurrence is *Wedelia gracilis* (Compositae). This plant is said to have been introduced in comparatively recent times into a Barbados garden and to have escaped from thence into other habitats, such as wayside banks, orchards and gullies. It is found in all parts of the island. It possesses herbaceous stems which bear numerous adventitious roots at the nodes. Other prostrate plants of the talus slopes are *Euphorbia prostrata* (Milk Weed); *Pilea microphylla* (=*P. muscosa*,—Euphorbiaceae), and *Desmodium incanum* (Sweetheart), Here and there erect herbs occur. These are chiefly quick-growing annual weeds, such as *Emilia sonchifolia* (Compositae); *Bidens pilosa* (Compositae) and *Euphorbia heterophylla* (Red Milkweed). Occasionally, deep-rooted plants with persistent woody stem-bases grow up between the stones. *Stachytarpheta indica* (Vervain) is the commonest of these, although *Sida* spp. and other similar plants more typical of dry pastures frequently occur along with it on many gully talus slopes.

(V) PLANTS OF THE GULLY CAVERNS.

In certain places at the base of the gully wall, there occur caverns, usually of no very great size, which present conditions favourable to the growth of several distinct kinds of mesophytic plants of sufficient interest to deserve special mention.

The caverns have been produced chiefly by the undermining action of the torrential streams to which the original formation of the gullies was due. In many cases they have been enlarged by the solvent action of subterranean water, or by the falling in of overhanging masses of rock near their mouths. Every grade of cavern is represented, from slight concavities in the gully-wall to deep excavations extending inwards and perhaps downwards for a distance of some forty feet.

The intensity of light in the deeper caverns is small. In their innermost parts it may be so low that few or none of the higher plants can thrive. Usually the only plants that occur in these dark recesses are blue-green algae, which form a slimy, greenish layer on the rock surface. The atmosphere inside the caves is humid, and frequently the walls are bathed with trickling water which comes out of the coral rock. The soil on the floor of the caves and on the ground near their mouths is usually moist and rich in humus. On the whole, the conditions are different from those of any habitat so far described.

The chief characteristic of gully-cavern plants is that they possess no structural modifications which might aid in checking loss of water by transpiration. This is no detriment to them, since water is plentiful. Their leaves are often large, wide-spreading, and so arranged as not to keep light from one another. Their blades are very thin and smooth, and of a rich dark-green colour. These characteristics are peculiar to plants that grow in shady moist places. Such plants are, therefore, often classed together as shade plants.

The chief *shade plants* of Barbados gully-caverns are:—

1. *Piper aduncum* (Piperaceae) Rock Bush or Elder Bush.
   This will be described later as a common undergrowth plant of Turner's Hall Wood. It is typically developed at the mouths of or just within gully caverns.

2. *Goniopteris tetragona* (Polypodiaceae,—Filicineae).
   A large-leafed fern with deeply divided thin fronds.

3. *Tectoria sp.* (Polypodiaceae,—Filicineae)
   A large-leafed fern whose leaves are divided into 3 or more squarish segments.

4. *Caladium sp.* (Araceae) Wild Eddoe.
   A tufted plant with arrow-shaped leaves of length about 1 foot.

Nearer the cave mouths, Rubiaceous plants abound. *Thyrsacanthus nitidus* is also common, as well as other erect plants which live best in rather subdued light.

Covering the moist walls of the caverns in regions where the light is sufficiently intense for growth to proceed, a few distinctive species of plants occur. The chief of them are:—

1. *Asplenium dentatus* (Polypodiaceae,—Filicineae) Asplenium Fern.
   The leaves of this small fern are 3 to 6 inches long, and are deeply divided into pinnae (each of length ¼ to ½ inch) arranged along both sides of the midrib.

2. *Phymatodes sp.* (Polypodiaceae,—Filicineae)
   A small feathery fern which grows best on those parts of the rocky wall where water is constantly trickling.

3. *Funaria sp.* (Muscineae) Funaria Moss.
   A small true moss which covers fairly large areas of the moist cavern wall with a bright green velvety layer. It is also found covering stones on the floor of the caverns.

Near the mouth of the caverns where the light is stronger, and the water-supply is not so constant, occur:—

4. *Gymnogramme calomelanos* (Polypodiaceae—Filicineae) Silver-backed Fern.
   The fronds of this fern are rigid and covered with a white powder beneath. They are deeply divided into pinnae, which are again divided into pointed lobes. The length of the frond is from 6 to 12 inches, rapidly tapering, being 2 to 4 inches broad at the base.

5. *Pilea microphylla* (=*muscosa*) Euphorbiaceae).

(B) GRASS AND HERB MESOPHYTES OF DRY PASTURES.

The areas of land that go by the name of "pastures" in Barbados are of two kinds:—

(1) **PERMANENT PASTURES.**—which should more strictly be called *meadows*, since animals are not allowed to graze on them. The majority of them are of Sour Grass. A few small pastures or meadows of Guinea Grass and a less number still of Para Grass also occur.

(2) **DRY PASTURES.**—of mixed vegetation, consisting of grasses of various sorts together with non-gramineous perennials, and a few annual plants.

(1) PERMANENT PASTURES.

The vegetation of these cannot be included under the heading of "Pure Plant Associations," since the chief plant in each of them (i.e. Sour Grass, Guinea Grass and Para Grass) has originally been planted by artificial means. Permanent pastures in this sense resemble cane-fields and will therefore be classified as cane-fields in a separate section.

(2) DRY PASTURES.

These are of frequent and ubiquitous occurrence in Barbados. They range in size between small areas of waste land near dwelling houses and estate buildings or along roadsides, to fields probably once under cane cultivation. They serve as feeding grounds for cattle, both those of sugar estate proprietors, and those of private owners and peasants.

In studying the flora of dry pastures, it might first of all be advisable to consider the factors which would be effective in deciding the nature of the association of plants occurring in them. The primary factor undoubtedly is the condition of the soil, especially with regard to its water supply. The soil of dry pastures is, in the main, shallow, of low water content, and of poor tilth, Here and there one notices, however, marked differences in soil condition, even in a pasture of small extent. These differences are due to change of slope, water-capacity and drainage, and they are sufficiently great to affect considerably the nature of the vegetation from place to place. The general dryness of a typical pasture, however, prevents the establishment of very many plants such as those which can only live through the dry season on deep, moist, porous soil, like that occurring in certain parts of gullies or in cane-fields. Only hardy, relatively- vigorous and extensively-rooted plants can possibly succeed in dry pastures. Of such plants, those whose root-systems are of permanent duration, or those which possess underground storage organs attached to their roots or stems, naturally have the advantage over plants which persist only for a relatively short time. Plants of the former type, unlike those of the latter, are able to grow continuously from season to season, and to retain possession of any site in which they have once established themselves. Further, they are able to use that site as a base from which to carry on a struggle for mastery over other plants in the vicinity. Thus one would expect to find perennial

plants rather than short-lived annual plants in a dry pasture in which the vegetation has reached a state approaching equilibrium.

The case of perennial plants with underground storage organs which persist throughout the driest weather, even when the shoots have withered, is especially interesting. Such plants, in a sense, are xerophytic during part of the year, and mesophytic during the remainder. They resemble in effect those trees which shed their leaves in periods of drought, and may, with the latter, be included in the group of plants known as "tropophytes", since they are adapted for life under changing conditions.

The persistent woody herbs also, to a certain extent, show xerophytic habit during the dry season, in that they shed many of their leaves, and so reduce loss of water by transpiration. In certain cases, the leaves are somewhat resistant, so that the plants approximate to xerophytes. Prostrate herbs are able to withstand drought, because their leaves are spread close to the surface of the ground where the air is more damp than it is in the less moist layers at higher levels.

Another factor of importance having bearing on the kinds of plants that are associated together in dry pastures, is the exposure of the herbage to grazing animals. In order for any given species of erect plant to survive the ravages of grazing animals, it must first of all, be firmly established in the soil and capable of quickly producing new leaf-buds. Perennial plants have this advantage over short-lived plants in so far as their root systems are concerned. Further, those firmly rooted perennials that possess persistent woody stems and branches, are able to produce new crops of leaf-buds almost as fast as the old shoots are nipped off by grazing animals. Prostrate plants are not exposed to the same danger of mutilation as are erect plants, and one would expect, therefore, to find many prostrate plants escaping destruction and growing normally in dry pastures, and this is indeed the case. The faculty of being able to defy the attacks of marauders is not possessed by all short-lived annual herbs, except they contain obnoxious juices, or are covered with formidable prickles.

Finally, a ready means of seed-dispersal may favour rapid spread (especially on freshly exposed or "new" lands), apart from the slower means of vegetative increase brought about by the growth of underground parts. Many typical members of the dry pasture plant association produce seeds or fruits which are furnished with spines or adhesive glandular hairs whereby they are enabled to stick to the feet and legs of grazing animals which thus bring about their dissemination.

The following lists of dry pasture plants of Barbados should be studied, therefore, with a view to elucidating the relationships between the nature of the pasture flora and the various and intricate factors to which the plants are exposed.

Speaking generally, it may be stated that the vegetation of a Barbados dry pasture consists of (a) several kinds of grasses, (b) certain prostrate herbs (chiefly Leguminoseae), and (c) several species of erect plants. Occasionally

(d) stunted shrubs occur here and there, but they do not generally enter into the dry pasture plant association.

(a) GRASSES OF DRY PASTURES.

These occur in flat patches or as low tussocks.

Individuals of one species of grass may form a patch of considerable size, to the almost complete exclusion of other species. Thus, a struggle is constantly going on for total possession. Occasionally as the conditions become favourable, one species of grass may be observed gradually to oust other species from its habitat.

It is believed that even the Sour Grass of the pure pastures or meadows for instance, is being exterminated in certain dry districts of the southeast part of Barbados by a recently introduced grass known as the Antigua Grass (*Andropogon caricosus*), which was originally introduced into the West Indies from the East. Further, it is common knowledge that grasses (such as *Paspalum conjugatum*, *Panicum sanguinale*, and *Panicum pseudischaemum*) frequently displace the more desirable Devil's Grass (*Cynodon dactylon*) on tennis lawns and cricket pitches in Barbados.

In the following list of dry pasture grasses it will be noticed that the most important of the grass species are perennials with persistent root-systems. It will also be noticed that these perennial grasses seldom, if ever, are characterized by the possession of long underground rhizomes. This fact is probably accounted for by the resistance opposed to the lateral growth of long rhizomes by the densely tangled roots of the tufted grass species and of other plants of the dry pasture association. This suggested explanation furnishes an example of the way in which one plant may react on another in a plant association, and of the means whereby one plant may defeat another in the struggle for domination in a particular region.

The commonest and most widely distributed dry pasture grasses are:—

(i) Perennial Grasses (which persist by underground parts).

1. *Cynodon dactylon*. Devil's Grass.
   Probably an introduced plant. It possesses short underground rhizomes. Its sub-aerial stems are of marked trailing habit, the prostrate stems frequently rooting at the nodes. These features probably account for its success in competition with the more erect grasses. The pasture Devil's Grass has very narrow and wiry leaves, and the stems are long, slender and often erect at their extremities. It thus differs in appearance from the much coarser sea-shore Binding Grass with which it is occasionally confused.

2. *Andropogon pertusus*. (=*Anaphilephis intermedia* var. *acida*). Sour Grass. (See under "permanent pastures.")
   Erect, tufted, but possessing short rhizomes.

3. *Sporobolus indicus*. Wire Grass.
   Erect, tufted, but possessing short rhizomes. The inflorescences are long and narrow.

4. *Paspalum conjugatum.* Broad-leaved Savannah Grass.
A prostrate grass with short rhizomes. Grows best in the moister places in pastures.

5. *Paspalum fimbriatum.*
Erect, tufted, with short rhizomes and broad leaves.

Cyperaceae (of grass-like habit). Botanically, these are not true grasses.

6. *Cyperus rotundus.* Nut grass. Cyperaceae.
Erect, tufted, with slender underground rhizomes to which are attached numerous small spherical tubers. The Nut Grass is thus very hard to eradicate when once it is established. It grows best in calcareous soils.

7. *Fimbristylis monostachya,* (and other species). Sedges. (Cyperaceae). These grow occasionally in the wetter parts of dry pastures, but are never common.

(ii) Annual Grasses.

Of lesser importance and more restricted in their occurrence in dry pastures are certain grasses described as annuals (*i.e.* short-lived plants which flower in the first year after their seeds have germinated). These grasses are generally incapable of persisting through a period of serious drought because of the absence of underground parts. Nevertheless they frequently occur in Barbados dry pastures, especially when the water supply is fairly good and the dry season not too severe. They are more common, however, along waysides.

1. *Eragrostis pilosa.*
A slender, erect, tufted grass, with fairly broad curled leaves.

2. *Eragrostis purshii.*
Similar to the above, but with narrower leaves.

3. *Panicum prostratum.*
A prostrate grass, with short stems arranged round the base of the plant. The leaves are short and broad.

4. *Eleusine indica.* Dutch Grass.
A tufted grass, usually prostrate, with flat leaves.

5. *Eleusine aegyptiaca.* Egyptian Grass.
Similar to the above in vegetative features.

6. *Chloris radiata.* Plush Grass, Bed Grass.
An erect tufted grass with narrow leaves. The inflorescence has 5 to 10 (or more) slender racemes which all come out from the very end of the axis.

7. *Cenchrus echinatus.* Burr Grass.
Stems prostrate at base, and erect at the ends. The inflorescence is a raceme (spike). The fruits are spiny, of diameter ¼ inch, and adhere to passers-by.

8. *Leptochloa mucronata.*
An erect tufted grass, with flat leaves and loose panicles of flowers.

(b) PROSTRATE HERBS OF DRY PASTURES.

These vary in abundance and in number of species, according to the soil conditions (especially as regards moisture).

In the driest and most exposed places, xerophytic types are dominant. These include certain plants already described in connection with the vegetation of sea-shore regions. The chief of them are:——

Portulaca oleracea (Purslane); *Sesuvium portulacastrum* (Seaside Samphire); *Pectis humifusa* (Duckweed); and *Lippia reptans.* In places in sandy dry pastures they dominate even over the grasses. Where the soil is a little less sandy and dry, other prostrate herbs along with certain grasses appear. The xerophytic plants are thereby expelled from these moister places, and the true dry pasture association prevails. It is to be noticed, however, that in the case of *Portulaca* and *Sesuvium*, a marked adaptation to a non-xerophytic habitat frequently occurs, for individuals of these genera possessing thin flat leaves, showing all stages of variation from succulence to the other extreme, are not uncommon in pastures where the soil is neither very sandy nor very dry.

The recumbent and prostrate plants of the more typical dry pastures consist (besides prostrate grasses) chiefly of genera of the family Leguminoseae. These plants grow between the stems and leaves of the grasses and other herbs, and show different degrees of luxuriance in accordance with the amount of moisture present. In very dry pastures, the prostrate herbs are stunted and stiff. The leaves are small and pressed close to the ground. In moister pastures, on the other hand, the stems are elongated, the leaves large, and the whole plant so markedly different from the stunted type, that, were it not for the constant floral features, it might be mistaken for a different species.

Several of the widely distributed prostrate dry pasture plants possess fruits which adhere to the feet or legs of grazing animals. The fruits of the *Desmodium* are especially characterized by this feature.

The commonest recumbent and prostrate herbs of dry pastures are :—

Leguminoseae.

Teramnus uncinatus (Rabbit Vine); *Desmodium incanum* (sweetheart); *D. procumbens; D. tortuosum; Stylosanthes procumbens* and *Rhynchosia minima* (Burnmouth Vine). In the moister regions there occur also, *Desmodium triflora; Phaseolus semierectus* and *Vigna luteola.* The two latter are common cane-field weeds.

Other families:—(Prostrate plants less commonly represented in dry pastures). *Euphorbia prostrata* (Milk Weed); *Pilea mycrophylla* (*muscosa*), and a few other plants which are more commonly weeds of open cane lands.

In moist pastures, *Commelina nudiflora* (Pond Grass) is occasionally found.

(c) ERECT PLANTS OF DRY PASTURES.

These include many species of different families. Their relative abundance in a pasture is decided by the many factors that have already been enumerated. Most of the erect plants are perennials with persistent woody stems. A few are perennials with underground storage organs, and a few are annual plants with herbaceous juicy stems. In the following list the plants are arranged under these heads.

(i) Erect Plants (not Shrubs) with more or less woody and persistent stems

By far the most abundant plants of this class, to be found in every Barbados dry pasture, are the various species of *Sida*. The commonest species is *S. glomerata*, but other species (e.g. *S. carpiniflora*) also occur. These latter are hard to distinguish from *S. glomerata*, and are therefore included with it in the general description.

Sida glomerata (Malvaceae)

An erect woody plant, growing to a height of 6 inches to 2 feet, but sometimes recumbent. It is sparsely branched, but it bears numerous tufts of stipulate, elliptical, dentate leaves, of average length 1 inch. The flowers are yellow, ¾ inch in diameter, and are borne either singly or in groups of two or three, closely seated in the axils of the leaves. The fruit has a brown membranous wall, and divides when ripe into 10 small segments (carpids), each of which possesses 2 spines. The fruit measures about ⅜ of an inch across, and each segment contains one seed. *Sida* seeds are probably disseminated by animals, to whose coats the spinose carpids adhere.

Other species of *Sida* (i.e. *S. urens* and *S. rhombifolia*) of common occurrence in dry pastures, differ somewhat in certain features from *S. glomerata*, but resemble it in general vegetative habit.

The following plants also resemble it in the possession of persistent, more or less woody stems, and of spinose, adhesive fruits or seeds :—*Achyranthes aspera, Boerhavia erecta, B. hirsuta,* (Hogweeds), *Triumfettia semitriloba* (Wild Hemp) and *Abutilon hirtum;* while the following have persistent, more or less woody stems, but possess fruits which are not adhesive, but either capsular or pod-like, and dehisce when dry.

Corchorus siliquosus (Broomweed) ; *Desmanthus depressus; Stachytarpheta indica* (Vervain) ; *Blechum brownei; Beloperone* sp. ; *Cassia polyadena* (Wild Tamarind) ; *Crotalaria retusa* (Yellow sweet pea) ; *C. verrucosa* (Blue sweet Pea) ; *Waltheria indica* (Buff Coat) ; *Capraria biflora* (West India Tea) ; *Tribulus maximus; Barleria lupulina* and *Baleria prionitis.*

Of these, *Crotalaria retusa* and *verrucosa* are often very conspicuous in certain dry pastures, not because of the abundance of individuals, but rather because of the showiness of their large racemes of brightly coloured flowers.

(ii) Erect Plants with persistent underground parts.

A few examples of this class of perennials occur in certain Barbados dry pastures. Only one of them is common. The others are rare, but worthy of note as they represent important plant types.

1. *Ruellia tuberosa* (Acanthaceae) Minnie Root or Many Roots.
   A common erect plant, growing often to a height of 1½ feet. It is much branched in a regular fashion when freely growing. The leaves are elliptical and of maximum length about 1½ inches. The flowers are large, funnel-shaped and bright blue in colour. They are arranged in cymes in the axils of the leaves or at the ends of the stem branches. The fruit is a narrow, elongated, many-seeded, dehiscent capsule, of length up to 1 inch. The persistent underground organs are true tubers (i.e. modified stem structures). They are about 3 inches long and ½ inch thick. They are arranged radially round the base of the stem. The plant usually flowers at the end of the wet season.

2. *Hypoxis decumbens* (Amaryllidaceae) Yellow Crocus.
   This frequents only the moist parts of dry pastures. It is about 9 inches tall, and bears yellow cup-shaped flowers of length ½ inch. The leaves are very narrow. The underground portion is a small pear-shaped bulb. The Crocus flowers and produces leaves only in the wet season.

3. *Hippeastrum equestre* (Amaryllidaceae) Barbados Red Lily, Easter Lily.
   A very showy plant of height about 1½ feet, bearing an umbel of large, funnel-shaped, bright brick-red flowers. The underground part is a large roundish bulb. The leaves are long, green and strap-shaped. The plant produces flowers in the dry season (January to April). The leaves appear in the wet season. *Hippeastrum* is rarely present in exposed typical dry pastures, but it is occasionally found in the upland districts of Barbados at the heads of gullies especially. It is often grown in gardens as an ornamental plant.

4. *Stenorrhynchus orchioides* (Orchidaceae)
   This plant is rarely found in dry pastures, and only occurs in fairly deep soil rich in organic matter. It is interesting in that it is an example of a Saprophytic flowering plant (i.e. a plant which obtains much of its food "ready made" from the humus of the soil in which it lives). The underground parts consist of numerous, thick tuberous roots which do not possess rootlets, but which obtain food by the agency of a fungus, which lives in co-operation with them (symbiosis). The sub-aerial part of the plant consists of a few pale leaves which soon die, and later a pinkish flowering stem of height about 1½ feet, bearing a raceme of unattractive tubular flowers, arises. The plant flowers in the dry season. (March and April.)

(iii) Erect Plants with herbaceous succulent stems. (True annuals).

In many pastures several herbaceous and comparatively short-lived plants occur in spite of grazing animals. They are naturally more abundant

in pastures not much used for grazing, and owe their success in competition with other pasture plants probably to their large output of seeds, and their efficient means of seed-dissemination. They are usually eventually ousted by the more favoured perennial plants which have just been described. The majority of these annual weeds grow also by the wayside and in waste places, and will be enumerated when those habitats are considered. They are chiefly species belonging to the family Compositae. Their variety depends to a large extent on the nature of the soil, because this influences the rate at which they can grow and multiply.

Special mention may be made, however, of *Argemone mexicana* (Yellow Mexican Thistle.—Papaveraceae) as it is possible that this annual owes its prevalence in many dry pastures to its numerous spines and perhaps also to its yellow latex, doubtless obnoxious to animals, which thereby learn to avoid the plant. Occasionally, the poisonous *Datura Stramonium* and *D. tatula* (Nightshade or Thorn Apple) survive on certain pastures for the same reason as does also the less harmful Castor oil plant (*Ricinus communis*).

(d) SHRUBS OF DRY PASTURES.

These are uncommon in typical dry pastures. Usually grazing animals eat off the stems of the seedlings of such plants before they reach maturity, or else they are purposely removed by human agency. Certain quick-growing shrubs, and shrubs heavily armed with spines, occasionally thrive in dry pastures. Most of these are characteristic of rocky land, and have already been described in connexion with the rocky land association of Barbados. The chief are:—

Jatropha gossypifolia (Belly-ache Bush); *Lantana* spp.; *Croton flavens; Cordia cylindristachya* (Sages); *Acacia farnesiana* (Sweet Briar); *Solanum igneum* (Bitter Berry); *Clerodendron aculeatum* (Wild Coffee); *Pisonia aculeata* (Black Thorn); and rarely, *Opuntia tuna* (Prickly Pear).

Occasionally specimens of *Pithecolobium unguis-cati* (Bread and Cheese) (a leguminous plant with numerous spines) occur in various parts of dry pastures which have been enclosed by hedges of this plant, or to which its seeds have gained access from some distant source.

It is highly probable that were dry pastures to be left quite undisturbed by man and beast, shrubby plants would gradually replace the herbaceous vegetation, and bring about the conversion of the dry pastures into original scrubby bushland.

(C) WOODY MESOPHYTES OF FORESTS.

The only remnants of the tropical forest which once undoubtedly covered the greater part of Barbados, occur in the Scotland District at Turner's Hall and Foster Hall respectively. The former is the more typical representative of the Mesophytic Forest Association.

TURNER'S HALL WOOD.

At Turner's Hall, the trees clothe the steep northern side of one of the spurs that radiate from the south-western portion of the rim of the Scotland

District. The height of this spur at its south-western extremity where it branches off from the rim is about 1,000 feet. Eventually the spur flattens and merges into the alluvial plain which borders the southernmost of the two rivers of the district. The spur is not clothed for the whole of its length with trees, but only for a distance of half a mile from its point of junction with the Scotland District rim, that is, for about a quarter of its length. The average width of the forest is about 300 yards. The soil in which the trees are growing is comparatively dry because of the smallness of the rainfall, and because of the good drainage of the land due to its elevated position. Hence also, the humidity of the air in Turner's Hall wood is low, a state of affairs enhanced by the strong winds that blow over the hill slopes for the greater part of the year.

For these reasons chiefly, the nature of the undergrowth of Turner's Hall Wood (as well as, to some extent, that of its arboraceous flora), differs considerably from that of most tropical forests.

The conditions existing in the Turner's Hall region at the present day are probably not the same as those in existence in former times when the Scotland District for the most part was covered with dense vegetation.

(a) NAMES AND DESCRIPTIONS OF THE FOREST TREES OF TURNER'S HALL WOOD.

1. *Hymenaea Courbaril.* (Caesalpinoideae,—Leguminoseae) Locust Tree. A tall straight tree, often reaching (in Barbados) a height of 50 feet. The diameter of the trunk is about 4 feet in the older specimens. Massive buttresses often support the trunk at the base. The bark is smooth, brown and soft, and exudes a resin when cut. The leaves are large and compound. They are twice pinnate, the pinnae (or leaflets) being about 1 inch long. During the dry season the Locust sheds most of its leaves (*i.e.* it is a deciduous tree). The flowers are not large, and are borne in terminal groups. They are of a white or pinkish colour, and are sweet smelling. The fruit is an oval, smooth, woody, brown, indehiscent (*i.e.* not splitting open when dry) legume, of length 4 inches. It contains a few large seeds. The wood of the Locust Tree is hard, and was much in demand in the early days of the sugar industry of Barbados for making rollers for cane-crushing mills.

2. *Cedrela odorata,* (Maliaceae) West Indian Cedar.
A tree of height up to 40 feet. The trunk is smooth, straight, of diameter up to 3 feet covered with palish brown bark. The leaves are compound, of 10 to 16 pointed leaflets each of length up to 2 inches. There is an odd leaflet at the end of each leaf axis. The leaves are deciduous. The flowers are tiny, whitish in colour, grouped in loose clusters, and have a peculiar smell. The fruit is a capsule which bursts (dehisces) into 4 valves and liberates the single winged seed, which is carried away from the parent tree by wind agency. The wood of the cedar is of great value in cabinet making. It emits an aromatic odour, is soft, and of an attractive brown colour; it is not attacked by termites (white ants).

3. *Chlorophora* (=*Maclura*) *tinctoria* (Moraceae) Fustic.

A middle-sized deciduous tree of height up to 30 feet. The horizontal branches are often wide spreading; the leaves are oval and pointed. The tree bears either male or female flowers. It is, therefore, dioecious. The flowers on the male fustic trees are arranged in pendulous racemes (called catkins). The flowers on the female trees are grouped together in globular heads, and give rise to compound fruits which are really made up of the several fruits from the numerous female flowers of the head. The Fustic yields a yellow dye. The wood is hard and is put to many uses.

4. *Sapium aucuparium* (Euphorbiaceae) Poison Tree.
A medium sized tree bearing numerous, bright green, elliptical, smooth, shiny, leaves of length up to 4 inches. The tree never sheds all its leaves at once, and is therefore an evergreen. The margins of the leaves are minutely dentate and each possesses two glands at the place where the blade joins the stalk. The flowers are either male or female, and are borne on common axes, which are situated at the ends of twigs. The male flowers are seated at the extremities of the axes, and the female flowers nearer the twig. The fruit is a small capsule. All parts of the Poison Tree exude a copious white juice (latex) when bruised or cut. This sets to a rubber-like substance on exposure to air. The wood of the tree is of no particular value.

5. *Dipholis salicifolia* (Sapotaceae) Bully Tree.
A fair sized tree with straight trunk, and many branches. The leaves are narrow, and of length 3 inches. They each possess two pointed tips. They are not all shed at once, hence the Bully Tree is evergreen. The flowers are tiny and are borne in great profusion in axillary clusters all along the branches. They are sweet smelling. The fruit is a black one-seeded berry of diameter ¼ inch. The wood was much used in the early days for house building.

6. *Lonchocarpus violaceous* (Papilionatae—Leguminoseae) Spanish Ash.
This well known tree grows to a height of 30 feet. The trunk is straight, stout, and is covered with smooth pale-brown bark. The leaves are compound, each consists of 3 to 4 pairs of oval leaflets of average length 2½ inches. The leaves are shed in the dry season, *i.e.* the tree is deciduous. The flowers are produced in June and July. They occur in pendant racemes, and are of a pale-purple colour. The fruit is a flat membranous pod, which generally contains one seed only. It is pointed at the ends, and of length about 3 inches.

7. *Acrocomia sclerocarpa.* (Palmae). Macaw Palm.
A palm tree of height up to 20 feet, with straight trunk which is densely covered with long black spines. The leaves are large and deeply divided into narrow pointed segments. The leaf axis and stem (peticle) are also covered with black spines. The flowers are borne on a much-branched inflorescence, which is subtended by a large woody, boat-shaped bract (or spathe). There are male and female flowers. The fruit is a hard drupe of diameter ½ inch.

The above-named trees are of most common occurrence in Turner's Hall Wood. There are other species which are found in smaller numbers, namely :—

8. *Hernandia sonora* (Hernandiaceae) Jack-in-a-Box.
Height up to 40 feet. Trunk, thick and straight bearing more or less horizontal branches at some considerable distance from the ground. The bark is soft, and is marked with a network of small ridges. The leaves are very large, (8 inches long) and heart shaped. They are attached to their leaf stalk eccentrically. There are male and female flowers. The fruit is a drupe with a yellow bladder-like envelope, which is the modified and enlarged calyx of the flower. The drupe itself is ¾ inch in diameter, and is black and hard. The wind produces a whistling sound as it blows on the envelope of the fruit.

9. *Hura crepitans* (Euphorbiaceae) Sandbox Tree.
(See under Shade trees).

10. *Bursera gummifera* (Burseraceae) Birch Gum.
Height up to 40 feet. The trunk is usually not very straight. Its bark is shiny brown, and peels off in papery flakes. When cut the bark exudes a copious transparent gum which smells like turpentine. The leaves are compound, of 3 to 9 pairs of leaflets, each of which is about 3 inches long. The leaves are deciduous.. The small flowers are borne in loose clusters chiefly at the ends of the twigs. The fruit is a drupe with a gummy outer layer. It is ½ inch in diameter, and of a red brown colour. It contains a single seed. The Birch Gum flowers in April.

11. *Oreodoxa oleracea* (Palmae) Cabbage Palm.
(See under Shade Trees).

12. *Eriodendron anfractuosum* (Bombacaceae) Silk Cotton Tree.
(See under Shade trees).

13. *Zanthoxylum fraxineum* (Rutaceae). White Hercules or Harkis.
An evergreen tree of height up to 20 feet. The trunk is slender, and is covered with prominent warty prickles. The leaves are compound, and the leathery green leaflets are of average length 2 inches. The flowers are borne in large loose bunches. The fruit is a splitting fruit (schizocarp) consisting of 1 to 5 segments (follicles), each containing a shiny black seed.

14. *Cecropia peltata.* (Moraceae). Trumpet Tree.
Height up to 40 feet. The branches come off horizontally high up on the stem. The leaves are borne in bunches at the ends of the twigs. The leaf is of characteristic appearance. It is large (diameter 1 foot) circular in general shape, with 9 well marked lobes. The leaf stalk joins the leaf-blade near its centre. The flowers are minute, and several clusters of flowers on separate axes are enclosed or subtended by a single large bract. The fruits are borne in bunches. Each fruit is of small size, is fleshy, and contains one tiny seed. The stems are hollow and sometimes harbour ants.

15. *Citharexylum quadrangulare* (Verbenaceae) Fiddle Wood.
(See under Trees with showy flowers).

16. *Coccoloba grandiflora* (=pubescens). (Polygonaceae) Leather-Coat Tree.
This is a small tree (of height up to about 15 feet), which has a marked resemblance to the common Seaside Grape (*Coccoloba uvifera*). The branches are few. The erect stems bear leaves in regular fashion all along their lengths. Each leaf is almost circular, of width 1 foot, and is seated almost stalkless on the stem. The leaf-base is usually lobed, somewhat encircling the axis. The flowers are borne in terminal racemes, and the fruit is a drupe. The wood of the Leather Coat is hard and red in colour. It was used formerly, when the tree was abundant in Barbados, for the same purposes as the Sea Grape wood is used, namely for making felloes.

17. *Cordia collococca.* (Boraginaceae) Clammy Cherry.
(See under Shade trees).

The above list includes most of the species of trees of considerable size which comprise the present day arboraceous flora of Turner's Hall Wood. The different species occur mixed together without any indication of gregarious growth. Several specimens of each of the first seven species in the list occur in various parts of the wood, but there are present only two or three of the others mentioned. In former times it is certain that many more species of trees than those named made up the primaeval forest that covered the greater part of Barbados. Schomburgk, for instance, in his "History of Barbados" (1847), includes in his plant list the names of several forest trees that are nowadays either not found at all in Turner's Hall Wood, or are only found occasionally in gullies, or as shade trees near dwelling houses or on sugar estates. It is difficult to decide how far these isolated specimens of trees may help one to reconstruct the full complement of the plants constituting the Mesophytic Forest Association of Barbados as developed in primitive times. This difficulty is due to the fact that many trees have been introduced in the early days as seeds or seedlings from other Islands of the West Indies and from other lands more remote, through the agency of man. Records of such introduction have not been kept, so that we have no reliable data upon which to reckon in our attempt to discover the nature of the primaeval forest of Barbados.

Comparing its present representative, as exhibited at Turner's Hall, (and allowing for the addition of certain other species not now present in it), with the forest flora of such districts as the mountainous and rainy regions of Dominica, Trinidad, &c., we notice at once a marked difference in the number of the various kinds of trees which make up the forests in the contrasted localities. The tropical rain forest of Dominica for example contains at least 176 species of trees as contrasted with the 17 or 20 species found in Turner's Hall wood.

As examples of trees found growing as more or less isolated specimens in different parts of Barbados (especially in gardens) the following may include species that may have once belonged to the original forest flora of the Island. *Erythrina corallodendron* (Devil's Tree or Coral Bean Tree); *Andira inermis* (Wild Olive Tree); *Peltophorum ferrugineum* and *Piscidia erythrina*. These trees are represented in the forests of certain other West Indies Islands and of South America, and, although it is possible that they all were not members of the arboraceous flora of Barbados, yet there is sufficient doubt about their introduction into the Island that one cannot decide whether they are indigenous plants or not.

Returning to the description of Turner's Hall Wood in its present aspect, it may be remarked that, because of the deciduous habit of many of the trees, the appearance of the wood varies somewhat in the different seasons of the year. There is a definite relation between external growth conditions and the periods of leaf fall, of flowering, and of fruiting of trees. This relationship is well shown in certain trees of Barbados, but not so well shown in others. Further, the nature of a tree itself (i.e. the kind of species to which it belongs), and even the individuality of the specimen, have also something to do with the periodicity of its vegetative activity. When the commonest trees of Barbados have been grouped, named and described, certain generalizations will be attempted which will perhaps help to elucidate the question of the periodicity of trees as exhibited in Barbados.

(b) PLANTS OF THE UNDERGROWTH OF TURNER'S HALL WOOD.

Besides the forest trees, there occurs in Turner's Hall Wood a certain number of shrubs and herbs forming the undergrowth. This undergrowth is not so luxuriant nor so varied as that of some tropical forests. The reasons for this are probably to be found in the nature of the soil (especially as regards moisture and humus-content), and in the low humidity of the air. Lianes are altogether absent, as are also epiphytes on the trees. One of the most conspicuous features of typical tropical forests is the presence of epiphytes such as *Tillandsia spp.* (Old Man's Beard and Wild Pine); and certain epiphytic ferns, palms and orchids. These plants almost cover the branches of the trees in the rain forests of Dominica, Trinidad and South America, but are never seen in Barbados.

The undergrowth in Turner's Hall Wood consists of two species of Mesophytic plants, *Piper aduncum* (Piperaceae) (Rock or Elder Bush) and *Thyrsacanthus nitidus* (Acanthaceae). Certain Rubiaceous plants (such as *Psychotria undata,* and *Faramaea spp.*) occur here and there, along with a few species of ferns and of other plants found also in gullies. The two first mentioned plants are shade plants, and they are able to live in the habitat chiefly because of the effect of the trees in eliminating direct sunlight. They form part of the forest association for this reason, and also for the attendant reasons that the soil is moister and the atmosphere more humid than it is outside the wood. Their presence illustrates thereby an important biological factor of plant growth.

DESCRIPTION OF THE TWO CHIEF PLANTS OF THE UNDERGROWTH OF TURNER'S HALL WOOD.

1. *Piper aduncum* (Piperaceae). Rock Bush or Elder Bush.
A shrubby plant of height up to 10 or 12 feet. The leaves are large, thin, and of an elliptical shape, and pointed at the ends. The average length of a leaf is about 5 inches. The flowers are very tiny, and are borne on an erect fleshy spike which looks very much like a small wax taper. The Rock Bush is a typical shade plant. The leaves are so arranged that little mutual shading occurs, so that, viewed from above, they exhibit a regular pattern, (or leaf-mosaic).

2. *Thyrsacanthus nitidus* (Acanthaceae).
A woody herb, sparsely branched, and of height up to 4 feet. Leaves thin, oblong and pointed. Inflorescence, racemose, but panicled at the base and terminal. Flower, white, ½ inch long, tubular and sweet-scented. A shade plant showing leaf-mosaic.

FOSTER-HALL WOOD—St. Joseph's Parish.

This second remnant of the primaeval forest of Barbados is situated immediately under the brow of Hackleton's cliff, at a distance of about ¾ mile due south of Foster Hall Estate. It has been partly preserved, probably by the will of former and present owners of the property. The chief differences between the habitat in which the trees at Foster Hall are growing, and that of the forest at Turner's Hall are that firstly, the substratum of the former habitat is rocky and of irregular depth, and secondly that its water supply is to a large measure derived from the tall limestone mass of Hackleton's Cliff, which passes water by seepage into the rock and soil of the wood at its base. Although the site of Foster Hall Wood faces to windward, yet its position is somewhat sheltered from the direct sea breeze by its proximity to the cliff, and by a slight elevation of the land in front of it.

As regards the flora of the wood, we must discriminate between the "lower wood" and the "upper wood." The lower wood (i.e. the most easterly part) contains the greater proportion of indigenous trees. Its arboraceous flora consists chiefly of *Sapium aucuparium* (Poison Tree); *Cecropia peltata* (Trumpet Tree); *Zanthoxylum fraxineum* (White Hercules); *Bursera gummifera* (Birch Gum); *Acrocomia sclerocarpa* (Macaw palm); *Chlorophora tinctoria* (Fustic); *Citharexylum quadrangulare* (Fiddle Wood); *Coccoloba grandiflora* (=*pubescens*) (Leather-Coat); *Tecoma leucoxylon* (White Wood); one or two species of Fig tree, (of which a large leaved kind, known to the inhabitants of the district as Redwood (*Ficus laurifolia* (?) is especially common), and an occasional specimen of Mastic (*Bumelia mastichodendron* (?)). Most of these species of trees have been mentioned as members of the forest flora of Turner's Hall Wood. There is, however, another tree which is quite common in the lower part of Foster Hall Wood (but much more common in the upper part); the Mahogany (*Swietenia mahagoni*. The mahogany is undoubtedly an introduced tree. Schomburgk adduces reasons (see his "History of Barbados" page 600) for supposing that this the best known and most abundant tree in Barbados at the present day, must have been introduced into the Island by man at some date subsequent to 1750. (The Mahogany is described

under "Shade trees"). The tree seems to be suited to the conditions of growth in Barbados, for it reproduces itself from self-sown seeds freely and rapidly in many habitats, especially where deep soil with a fair supply of moisture is available. Thus in Foster Hall Wood, the Mahogany Tree has spread so rapidly that it has produced a great change in the composition of the Wood, especially in its upper part. In the latter region the Mahogany is by far the most abundant species, and it appears to have ousted many of the original indigenous tree species which have not been able to spring up again after the old specimens have been removed by man, or have died a natural death. The undergrowth of the upper part of the Wood has been stifled also by the vigorous seedlings of the Mahogany, so that the aspect of the vegetation here has been entirely changed. Whereas, then, the lower part of Foster Hall Wood includes relatively few specimens of Mahogany, and its arboraceous flora on the whole is similar to that of Turner's Hall Wood, the upper part of the Wood is composed chiefly of Mahogany trees with only a few individuals of other species. Amongst the latter, *Sapium aucuparium* (Poison Tree) is the most abundant, although Fiddle Wood and Fustic are also represented.

Considering the undergrowth of the two parts of Foster Hall Wood, it is to be noticed that the undergrowth of the lower part is very luxuriant in comparison with that of Turner's Hall Wood. The rocky substratum, with its deep pockets of soil, supports a varied flora of tree seedlings (of which Fiddle Wood is especially conspicuous), rock xerophytes (including most of the plants described under "Plants of rocky land") and mesophytes (such as the two shade plants which make up the major part of the undergrowth of Turner's Hall Wood), and along with them, many of the mesophytes of gullies.

It is doubtful, in the face of the abundance of undergrowth plants typical of pure plant associations such as rocky land, whether one is justified in alluding to the flora of lower Foster Hall Wood as a "pure, woody, mesophyte association." It might better be included under "mixed associations."

In the upper part of Foster Hall Wood the undergrowth, as has been stated before, consists chiefly of vigorous seedlings of the Mahogany with relatively few other species of plants.

The lesson to be learnt from a study of Foster Hall Wood is chiefly the marked effect which the introduction of a new and well-adapted plant (in this case the Mahogany Tree) may produce on the characteristics of the vegetation of a mature and natural plant association. This effect is especially well seen in Foster Hall Wood in connection with the suppression of the original undergrowth by the prolific production of seedling plants by the introduced species.

THE HYDROPHYTE ASSOCIATIONS OF BARBADOS.

CHAPTER XI.

(A) TRUE HYDROPHYTES.

The conditions of life of plants which live totally submerged in water, either fresh or salt, are very different from those of plants that live on land, yet true hydrophytes are adapted to their special environment, and exhibit

characteristic features. It would be advisable before considering actual examples to investigate the general nature of the factors governing the growth of plants living totally submerged in water, and to examine how far these plants are suited to their special environment.

In the first place, water, which is necessary for the growth of all plants, is here always present in abundance. The whole plant body of a submerged hydrophyte is exposed to it, and absorption may take place through every part of the plant's surface, rather than at one particular region such as the root. The outer skin (epidermis) of the plant may therefore without detriment, be thin instead of thick as is the case of land plants in which protection is needed in order to prevent the plant tissues from losing water excessively by transpiration. Further, an absence of water-conducting tissues in hydrophytes will not be a drawback as it would be in the case of land plants, in which it is necessary for the plant to possess, not only an elaborate absorbing root system, but also efficient conducting tracts for conveying water to all parts of the organism. Secondly, the surrounding water supports the submerged parts of true water plants so that they can expand their green tissues without the aid of stiff upright stems, or of special strengthening fibres. Hence water-plants can grow without the expenditure of much building material. Hydrophytes seldom contain more than 5 per cent. of dry solid matter as compared with 10 to 40 per cent. in land plants.

Thirdly, as regards the air content of the medium in which true hydrophytes live, it must be noticed that carbonic oxide is just as essential for the growth of green submerged plants as it is for ordinary land plants. Natural water (such as that which occurs in the sea, in rivers, lakes and ponds) always contains dissolved air, but this contains a higher percentage of oxygen and of carbonic oxide than does atmospheric air, by reason of the greater solubility of oxygen and of carbonic oxide as compared with that of the third chief component of air, namely nitrogen. In many water-plants, there are present air-chambers and passage-ways for the distribution of the gases liberated during the activities of the green tissues of the plant. These air-chambers also increase buoyancy, which is advantageous to hydrophytes.

Fourthly, the light conditions of submerged hydrophytes are just as important to the successful growth of the plants as of land plants. Light is somewhat weakened in intensity, partly by reflection from the surface of water, partly by absorption in water, and partly by the scattering effect of particles of solid material which float in water. The deeper the water and the muddier it is, the greater the weakening effect on light intensity. Submerged water-plants are therefore seldom exposed to strong light, resembling shade plants in this respect. They exhibit such features as largeness and thinness of leaf, which we have learnt to connect with shade plants.

Finally, the temperature of the medium in which hydrophytes live is more uniform than that of the environment of land plants. This is due to the fact that water gains and loses heat much more slowly than does air or soil, and plants growing in it are never exposed to sudden changes of temperature as is the case with land plants, especially land plants of temperate countries subjected to frost.

On the whole, then, the conditions of growth of submerged hydrophytes are remarkably uniform, and it is not surprising that aquatic species of plants possess a very wide geographical range. The distribution of the species is brought about under natural conditions by agents such as ocean currents, winds and birds. Ocean currents freely carry floating hydrophytes over great distances; winds transport small seeds of certain hydrophytes from one region to another, and birds, (especially those that haunt ponds and rivers), carry away fruits and seeds of hydrophytes, either attached to mud adhering to their feet, or else contained in their crops or alimentary canals, to be ejected subsequently in another place.

(1) FREE-SWIMMING OR FREE-FLOATING HYDROPHYTES.

These plants constitute several plant associations, of which the most important are the Plankton and the Floating Pond-Association.

(a) PLANKTON.

This term denotes collectively the bodies (either alive or dead) of minute organisms, both animal and plant, which float passively in water. The plankton is especially well-represented in the ocean, but it is not absent from any natural waters. It forms the chief food of fishes.

Although we are concerned here only with living plant-forms, yet mention may be made of the presence in Barbados of thick deposits consisting largely of the fossil remains of certain animal and plant members of plankton known as Radiolaria and Diatomaceae respectively. These deposits occur in the Scotland district and are included in the Chalk of the Oceanic Beds. They go by the names of Barbados Earth, Siliceous Earth, or Diatomaceous Earth. They are of considerable geological interest in that they indicate the great depth at which the Oceanic beds of Barbados must have been deposited, because similar fossil plankton are found on the bed of the present day ocean only at depths below 1,000 fathoms.

The sea which washes the shores of Barbados is rich in plankton, of which the chief plant-forms belong to the families Diatomaceae, Cyanaphyceae (or Blue-green Algae) and Peridinae. It is only by examining sea-water microscopically that the structures of the minute plants can be discerned, but investigation has shown that they are well suited to their habitat, in so far that their adaptations have developed in two directions;—first, to increase the surface area with the least possible employment of material, and second, to decrease the specific gravity of the organism.

(b) FLOATING HYDROPHYTES OF PONDS.

These include simple filamentous plants belonging to a botanical group known as the Green Algae and also certain peculiar species belonging to the seed-producing plants. In Barbados there are represented only a very few species of true floating Hydrophytes. Of the Green Algae, a common form known as *Spirogyra* occurs in many ponds. Good specimens of this simple plant may be obtained at Graeme Hall in the ditches of the swamp. The appearance of the alga is that of a mass of delicate green threads. The plant is buoyed up by tiny

bubbles of gas liberated during vegetative activity. Microscopic investigation reveals the existence of two species of *Spirogyra* in Barbados ponds, the difference between them lying in the form of the spiral band of green substance which is present in the cylindrical cells of their filaments. The chief representative (and as far as is known, the only representative) in Barbados of floating hydrophythic Flowering Plants is the cosmopolitan plant known in England as the Duckweed (*Lemna minor*). This occurs only here and there in Barbados. It may be found growing in the quieter parts of the small watercourse that flows near Three Houses Sugar Factory in the parish of St. Philip.

DESCRIPTION

Lemna minor (Lemnaceae) Duckweed.

(This must not be confused with the xerophytic Duckweed (*Pectis humifusa*) of sandy sea shores).

A small plant, whose green part consists of a tiny, floating green plate (diameter ⅛ inch), which is said to represent the stem, modified so as to function as a leaf. From the under surface of the plate a long root hangs down into the water. The plant reproduces itself chiefly by the detachment from the parent of small branches which grow out from the edge of the green plate. Occasionally tiny, much-reduced flowers are formed, but it is only rarely that seeds develop. The Duckweed is, in fact, a greatly reduced plant which has almost lost the power of reproducing itself by means of seeds. The rapidity with which the plant is propagated by vegetative means, however, enables it, under suitable conditions, rapidly to cover the surface of a pond to which it has gained access.

(2) ANCHORED HYDROPHYTES.

These plants are divided into two classes according as they are anchored to a substratum of rock or to one of soil.

(a) ROCK-ANCHORED HYDROPHYTES.

The most common group of water-plants which are characterised by the habit of growing attached to stones or to anything firm beneath the water's surface are the Algae (Water Mosses) both marine and fresh water.

The *fresh water Algae* are not very common in Barbados. There are only one or two species of rock-anchored forms, and these have not (to the writer's knowledge) been fully investigated. There are few suitable habitats for their development in the ponds of the Island, which may in part explain their scarcity.

The *Marine Algae* (Seaweeds or Sea Mosses) are well represented around the shores of Barbados, and their remains may frequently be seen washed up on sandy beaches. Mention has already been made of this fact in the description of the beach plants of the Maxwell coast of Barbados.

Typical representatives of the marine algae may be seen at low water on the rocky coast of Barbados, particularly near Bath and along other parts of the sea border of the Scotland District. They will here be noticed to be living attach-

ed firmly to the rocks. The algal flora of the sea forms a zone round the coast and is only found in certain depths of water. It appears that at about 150 feet below sea level, as a rule, all growth ceases, by reason of the low intensity of light essential to the nutrition of these plants. Hence, exclusive of miscroscopic floating plants of the Plankton, the characteristic flora of the sea is restricted to a comparatively narrow zone lying between high tide mark and some 150 feet below low water. The plants of the algal flora of the sea fall into three large groups which are roughly characterised by their colour as the Green, Brown and Red Seaweeds. These groups are represented by Algae in all parts of the world, and it happens that the colours mentioned run, to a certain extent, parallel with other characteristics of form and propagative methods by which the large groups are more strictly defined. It has been found that the colouring has an important physiological meaning. Green plants make special use of the red rays in sunlight for purposes of nutrition. The rays of other colours (blue, green yellow, &c.) which together constitute light of a greenish tint, they reflect, and it is for this reason that such plants look green. For Brown and Red Seaweeds, rays of a blue colour are especially effective, and it is such rays that penetrate farthest into the depths of the sea water. Thus the colourings have a probable relation to the nutrition of the seaweeds which show them. In particular, the possession of a brown or red tint makes nutrition at great depths possible to those plants which possess them, while it does not appear to be injurious to life at lesser depths. Hence, generally speaking, the Red Seaweeds are more prevalent at the greatest depths, where Brown and Green Seaweeds are less abundantly represented. The Brown Seaweeds extend from the shallowest water downwards, but stop short at the greatest depths. In shallow water all three kinds may be present, and this is observed to be the case near the shores of Barbados.

It is of little interest to know the names of all the seaweeds that might be found near Barbados; indeed they have not all been correctly determined, but it may be worth while to describe one or two of the commonest of them in order to get some idea of the adaptation which these plants show to their environment.

1. *Ulva sp.* (Green Alga) Sea Lettuce. (Leaf-like form).
   The plant body consists of thin, broad, shiny, bright-green expansions of simple outline. It is soft, somewhat slimy and flexible, and is frequently seen in detached masses on sandy beaches. In its natural environment it is attached to rocks by means of disc-like organs called haptera. Because of its strong tough structure, and its smooth slimy surface, Ulva is particularly well adapted for resisting rupture by the beating of the waves. Further, it can also withstand drying up when lying exposed to sun and wind during periods of low tide by reason of its protective covering, and the slimy layer on its surface.

Many other leaf-like forms of Alga occur in the sea near Barbados along with *Ulva*, but the majority of them are of a brown colour. Of these Brown Algae, *Sargassum*, deserves special note.

2. *Sargassum bacciferum* (Brown Alga) (Leaf-like form).
   This is a highly organised seaweed, which shows a differentiation of plant body into leaf-like and stem like regions. It also possesses clusters of small spherical bladders, which maintain it in an upright and outspread position when living attached to rocks, or keep it floating when it has broken loose from the substratum. Sargassum may thus be

carried great distances by means of ocean currents, which fact accounts for its presence in large masses in the Atlantic, especially in the Sargasso Sea where the movement of water is so slight that the seaweed is said to have formed floating meadows.

More common than the leaf-like seaweeds are the filamentous forms, of which every variety of branched and unbranched, slender and tough plant body may be noticed. Certain of them are green Algae but may belong to the Red. The filamentous type gradates into the moss-like form. Of seaweeds of these latter kinds, every conceivable variety occurs, but the majority of them are Red Algae. Finally, the crustaceous type is well represented in the seaweed flora of Barbados. Crustaceous seaweeds have the characteristic habit of secreting calcium carbonate (lime) which forms white masses covering their rounded expansions or branches, and in this way perhaps serving to protect the plant, and to increase its length of life, for it is known that such crustaceous seaweeds are perennial, whereas most of the non-encrusted forms are annual or short-lived

(b) SOIL-ANCHORED HYDROPHYTES.

This term is meant to imply that certain water plants are anchored to a substratum, which not only serves to fix their position, but also to provide the plants with a certain amount of nutrient material. Associations that are made up of water-plants of this sort include plants of all types, — algae, true mosses, ferns, and flowering plants. We may distinguish in them two groups, which are more or less distinct; hydrophyte associations of brackish water and hydrophyte associations of fresh water. Both groups are well represented in Barbados.

(i) Soil-anchored Hydrophytes of Brackish Water.

This association occurs most typically in Barbados at Graeme Hall swamp, St. Lawrence, but it is there represented by a few plants only, and is not sufficiently free from interference by man to exhibit any particularly striking features. However, a description of the characteristic plants of the Swamp will enable one to understand the adaptations of Hydrophytes of the above group to their environment.

1. *Chara sp.* (Green Alga) Hornwort or Stonewort.

This is a plant consisting of longish, branched slender stems bearing whorls of narrow leaf-like structures at regular intervals. There are from 5 to 10 leaves at each node, and the length of each is about 1½ inches. The whorls are more closely collected near the end of the stem than elsewhere, and growth is apical. Reproduction is carried on both by vegetative means, and also in a simple way by spores which are formed within bodies attached to the under surfaces of the leaves. The whole plant is held erect by the water, for although its parts are somewhat brittle because of lime in the cell-walls, yet the stems are not provided with strengthening tissue and are unable to keep the plant rigid in air. *Chara* forms dense masses at the bottom of the Swamp, being rooted by a short root system to the muddy substratum.

2. *Ruphia maritima* (Potamogatonaceae) Tassel Pond Weed.

This is a much-reduced flowering plant whose plant body consists of very long branched, slender, green stems bearing, at intervals of about 2 inches, one or two narrow and much elongated, flattened, hairlike leaves. The whole plant when removed from the water is flaccid and slimy. *Ruphia* is anchored in the muddy substratum by means of a persistent, branched, root-bearing stem system (rhizome), so that it is able to continue growth for several years, and to populate the water with a dense tangle of shoots. *Ruphia* is said to bear tiny flowers at the surface of the water, but these are never produced, to the writer's knowledge, in Graeme Hall Swamp.

Growing amongst the mass of *Chara* and *Ruphia* in Graeme Hall Swamp, certain filamentous, green Algae mentioned above (i.e. *Spirogyra* spp &c.) occur, the total collection of Hydrophytes making up the plant association of this habitat. In conclusion it may be stated that in many regions of the sea near the coast of projecting land masses, it is not unusual to find *Ruphia* and other similar hydrophytic flowering plants, along with certain large Algae (such as *Caulerpa*) growing in luxuriance, and although no typical examples are on record for Barbados, yet near the coast of other West Indies Islands, examples of such a marine association of anchored hydrophytes attached to a loose substratum, have been noted. It is highly probable that the populating of the Swamp at Graeme Hall with *Chara* and *Ruphia* was due in the first place to the encroachment of the sea which carried individuals of these plants from the ocean to the site where they are now found.

(ii) Soil-anchored Hydrophytes of Fresh Water.

This association is the most striking of the Hydrophytic plant associations. It is the common plant association of ponds, and is almost uniform in general features, no matter in what part of the world it is developed.

(iii) General Features of Barbados Ponds.

There are still left in Barbados on certain sugar estates, or in waste places, a few stagnant ponds of small size. These are used chiefly for watering cattle. The largest of them contain water all through the year, and continuously maintain a flora of water-plants. The smaller ponds dry up during the months of March and April, and any plants which are growing in them in the wetter months of the year either die down altogether or, in certain cases, exist in a more or less parched condition until the rain replenishes their habitat with water.

The plants of the larger stagnant ponds often show a marked zonation, that is, at different distances from their margins the vegetation is characterised by different kinds of plants. Thus, along the edge of a typical pond, tall sedges (or rushes) occur, mixed with certain grasses and other plants. In the very shallow water or wet mud near the margin of the pond, dense masses of the Water Hyacinth (*Eichhornia*) occur. Where the water is a little deeper Water Lilies abound. In the deeper water also, one frequently sees plants of the Water Hyacinth floating about entirely unattached to the substratum.

Occasionally the small floating Duckweed (*Lemma minor*) forms a bright-green layer on the surface of the water in the centre of the pond, but this plant is not a regular member of the flora of Barbados ponds. Entirely submerged in the deeper water are a few aquatic plants belonging to the Algae. These form tangled masses at the base of the pond or between the stems of the rooted water plants growing from it. The more important of them have already been named, for example, *Spirogyra* and *Chara*.

We are concerned at this place with the plants of the deeper water, for those growing round the edges of the pond belong more properly to a group, known as "Swamp hydrophytes". The hydrophytes now to be described are rooted in the black muddy bottoms of the ponds. They are the Water Hyacinth (*Eichhornia speciosa*) and the Water Lily (*Nymphaea ampla*, &c.)

1. *Eichhornia speciosa* (Pontederiaceae) Water Hyacinth.

   This is an introduced plant. Its place of origin is southern U.S.A. It is found in most estate ponds in Barbados, probably having been placed there by planters because of its showy flowers. The leaves are roundish, leathery, and shiny, and of average length 3 to 4 inches. They taper into the stout leaf-stalks which are not markedly swollen in those individuals which live near the pond-margin. The stem is a peculiarly-branching rhizome which is rooted in the mud by means of numerous fibrous roots. The inflorescence is a spike of length about 9 inches. It bears delicate large flowers of a pale bluish-mauve colour. The corolla of each flower has a yellow patch on the inside of its upper part. The leaves of *Eichhornia* frequently completely hide the mud in which the plants grow. Many of them break loose and float into deeper water. The leaf-stalks of these detached individuals become swollen and bladder-like, so that they buoy up the leaves and keep them above the surface of the water. Roots grow out frequently from the bases of the petioles, and these sometimes eventually anchor the plant in the mud. The leaves and leaf-stalks of the Water Hyacinth are plentifully supplied with internal air-spaces, so that the tissues of the plant are well aerated.

2. *Nymphaea ampla* (Nymphaeaceae) Water Lily.

   The leaves of this typical water-plant are circular, slightly heart-shaped, and of diameter 3 to 4 inches. They are borne on stout stalks that arise from rhizomes embedded in mud at the bottom of the pond. These rhizomes can exist for some time even when the pond dries. The young leaves are rolled at first so that they can easily push aside the older leaves which cover the surface of the water. The leaf-stalks have the power of elongating when the level of the water rises. The floating leaves of the Water Lily are limp and flabby when removed from the water. They are supported by the water when in their natural habitat and, therefore, have no need of stiff stems. The upper leaf-surface is water-proof, being covered with a layer of wax. There are no openings (pores or stomata) in the lower surface, but only in the upper surface, where they are very numerous. In the leaf-stalk, the air-spaces are large. Air-spaces also occur in the rhizomes and in the leaf-blades. Air thus has free access to all parts of the Water-

Lily plant. The root system is very small, which is not a drawback since water is very abundant in the substratum in which the plant is anchored. The flowers of the Water-Lily are about 3 inches in diameter. They have numerous petals and stamens. Their colour is white, inclined to pink in the centre. The fruit is a woody capsule which splits up into several parts which float away, and eventually become waterlogged and sink to the bottom of the pond where they germinate.

A few other Water Lilies are occasionally found in ponds in Barbados. They have mostly been introduced by man. In certain ponds (e.g. Hampton estate), the Red-flowered, large-leaved Nelumbium occurs.

(3) SWAMP HYDROPHYTES OF POND MARGINS.

Plants of fresh water swamp associations are rooted in a muddy waterlogged substratum, but their leaf-bearing stems are held aloft above the surface. Swamp plants therefore connect true submerged Hydrophytes with Mesophytes, and they show characteristics of each plant-type. For instance, they often possess the aerating system of the former, and the strengthening and conducting tissues and the thick epidermis of the latter. In Barbados, the swamp plants named below occur along the margins of many of the ponds. Of the true grasses (Gramineae) the following genera grow luxuriantly near ponds; *Panicum* spp: *Paspalum* spp: *Leptochloa mucronata; Chloris radiata; Eriochloa punctata; Setaria setosa*, &c. Most of these belong really to the flora of the pasture or field in which the ponds are situated, but their luxuriance causes them to be conspicuous amongst the plants of pond margins. Occasionally, the grasses are rooted in the marshy soil and have their bases covered with water.

Along with grasses, certain other plants occur near marshy pond-margins, chiefly by reason of the abundance of water there. Like the grasses they are not typical swamp plants, and show few features of special interest. As examples the two following plants may be noted.

1. *Commelina nudiflora* (Cayennensis). (Commelinaceae) Pond Grass.
(See under "Plants of Cane Fields")

2. *Caperonia castaneifolia* (Euphorbiaceae) Marshy Croton.
An annual erect herb, of height up to 2 feet. The leaves are narrow and pointed, and possess well-marked parallel veins. Their margins are dentate. The flower is small, white, and is either male or female. The fruit is a capsule of diameter ¼ inch. Both the stem and the fruit are covered with glandular hairs.

Finally, we come to the true *Swamp Hydrophytes*, of which two typical representatives occur along the borders of ponds in Barbados, and occasionally on the sides of watercourses. They are:—

3. *Jussiena suffraticosa* (Oenotheraceae).
This is an erect plant of height up to 4 feet, with woody base and smooth, dark reddish-brown, angular stems, with many side-branches.

The leaves are narrow and pointed, and of average length 2 inches. The flowers are yellow, and possess 4 petals. The diameter of the flower is about 1 inch. The fruit is a 4-celled elongated narrow capsule, containing many small seeds. Its length is about 1½ inches.

4. *Echinodorus rostratus* (=*Alisma cordifolium*) (Monocotyledones) (Alismaceae) Water Plantain.

This plant occurs along the margins of a few of the Barbados ponds. It is rooted in the ground but its leaves are sub-aerial. It possesses under ground rhizomes whereby the plant is perennated when the pond dries. The leaves are large, roundish, heart-shaped, and of length 3 inches. They spring up round the base of the plant in a rosette. They have cremulate margins. The flowers are arranged in bunches along the sides and at the end of the tall inflorescence-axis, forming a large loose panicle. The flower is small and white, and possesses 3 petals only. The fruit is a spherical spiny structure, containing one seed.

Much more prevalent than either *Jussiena or Echinodorus* is the Common Rush (*Eleocharis mutatus*) whose green, upright, triangular or round, stiff stems line the sides of most of the ponds of the Island. This plant possesses, however, marked xerophytic features, and belongs really to the next class:— Xerophytic Hydrophytes.

(B) XEROPHYTIC HYDROPHYTES.

Plants belonging to this class, although they are rooted in the waterlogged substratum, yet exhibit xerophytic features in their sub-aerial parts. The reason for this is that either the water of the substratum is so saline that their roots cannot absorb it, or it is so rich in peaty material that it exerts an effect similar to that of salty water.

In Barbados, xerophytic hydrophytes are represented by Sedges and Mangrove plants.

(1) SEDGE-SWAMP PLANTS. (SEDGES).

These are grass-like plants of general tufted habit, which possess sub-aerial parts specially constructed to reduce transpiration. Leaves are absent altogether in the commonest Sedge, their place being taken by stiff green stems. In other species, the leaves are present, but they are provided with a thick shiny epidermis, and expose a comparatively small surface to the air. Although sedges occur along the marshy borders of many fresh-water ponds, they are most typically developed in the brackish marshy land which occurs in a few localities in Barbados, such as Graeme Hall Swamp.

Along the borders of the water at Graeme Hall Swamp the following sedges occur. (They are erroneously called Rushes locally).

1. *Eleocharis* (=*Scirpus*) *mutatus.* (Cyperaceae) Rush.
A tall erect plant, whose green triangular stems take the place of leaves of which the plant is devoid. The stems are surmounted by scaly, pale-

brownish, spiky inflorescences. Height 1 to 2 feet. The interior of the stems is pithy and contains abundant air-spaces, allowing of free aeration of the submerged parts of the plant and of the root-system situated in the water-logged substratum. A taller sedge, similar to the above (except that its stems are round) occurs frequently, along with the triangular stemmed sedge. Its inner pith consists of narrow plates of tissue traversing the stem from side to side and at small intervals along its length. It is perhaps a variety of the more common triangular sedge described above.

2. *Eleocharis capitata* (Cyperaceae) Grass-Rush.
A small tuft-like sedge with very numerous wire-like green stems, surmounted by small, brown scaly inflorescences. Leaves are absent. The bases of the stems are red in colour as are also the roots.

3. *Fimbristylis monostachya* (Cyperaceae) Club Rush.
A grass-like plant with narrow, pointed, wire-like, green leaves of average length 1 foot. The stems each bear a single compact inflorescence of a brown colour near its extremity, and to one side.

4. *Fimbristylis ferruginea* (Cyperaceae) Rusty Club-Rush.
Similar to the above, but the leaves are longer, and the inflorescence consists of several clusters of rusty-red spikelets of scaly flowers, arranged above two long leaf-like structures that grow out from the stems below them.

There is another swampy region of small extent situated below St. Ann's Fort, near Bridgetown, on the sea coast, and just to the west of the area covered with trees and scrub belonging to the "Coccoloba association" described in detail elsewhere. Here, the chief brackish-water swamp plants are one or two species of sedge (chiefly *Eleocharis monostachya*) along with much rank Binding Grass (*Paspalum distichum*). Similar areas occur here and there near the coast in other parts of Barbados, but they are not worthy of special description.

(2) MANGROVE-SWAMP PLANTS.

At a few localities only do Mangrove swamps occur in Barbados. The two most typical examples are found at Greame Hall Estate, and near the Bridgetown Railway Station on the river which enters the Careenage. The swamps at these places are doubtless only the remnants of previously extensive marshy regions of brackish water which may have lined the banks of estuaries for a distance of a mile or more inland. Probably at one time Mangrove swamps were of common occurrence along the low-lying shores of the southern and western coast of Barbados. The present day examples afford only a meagre idea of the features of Mangrove vegetation such as form a well-marked plant association along the shores of certain other West Indies Islands and of the mainland of South America.

In Barbados, two trees characterise the Mangrove Swamps. They are the true Mangrove (*Rhizophora*) and the somewhat similar White Mangrove (*Laguncularia*). The latter is by far the commoner in Barbados. In other

countries *Rhizophora* is the dominant plant of the association, and many other trees and shrubs besides *Laguncularia* occur along with it. It is even possible to distinguish between an Eastern Mangrove Association (as developed in Africa, Australia, &c.) and a Western Mangrove Association (as seen in America), according to the kinds of xerophytic-hydrophytic woody plants that make up the association.

DESCRIPTION OF THE MANGROVE TREES OF BARBADOS.

1. *Rhizophora mangle* (Rhizophoraceae) True Mangrove.

A small tree with numerous branches, and with trunk provided with many bow-like prop-roots which radiate on all sides, and help to support the tree. Without these roots the foundation of the plant would not be firm in its muddy substratum. The prop-roots are provided with large air-spaces, which are in communication with the outer air at spongy places in the bark known as lenticels. Thus air can reach the root-system of the plant, which would otherwise be unprovided with air, since the soil in which it is embedded is waterlogged. The leaves of the Mangrove are xerophytic in structure. They possess a thick epidermis, covered with a shiny cuticle. They are leathery, and have few stomata. The plant thus conserves its moisture, an essential protection, since the water at its roots is too saline and peaty to be absorbed by the roots. The seeds of the Mangrove have the extraordinary feature of germinating on the tree. The root of the suspended seedling grows to the shape of an elongated cigar, and, by reason of its weight and sharp extremity, it penetrates the mud at the base of the parent tree when it falls. If the seedling falls into deep water, it floats upright, and may be carried by wind or current to a shallower place where its root tip can reach bottom and strike. This mode of reproduction is well suited to the mode of life of the Mangrove.

2. *Laguncularia racemosa* (Combretaceae) White Mangrove.

This is a small erect tree with many branches. It possesses no prop-roots. The leaves are leathery and shiny, and possess reddish leaf-stalks. The leaves are set edgewise to the sun's rays, which is a further means of checking excessive transpiration. The flowers are small and whitish. They are borne in clusters. The fruit is small and bottle-shaped. It does not germinate on the tree. The stem buds of the White Mangrove are protected by the thick young leaves being so arranged as to enclose them. They thus lose little moisture by evaporation, and are not exposed to injury by too strong light.

The Olive or Dwarf Mangrove (*Avicennia nitida*) (Verbenaceae) although mentioned by Schomburgk as occurring in Barbados and although common in other West Indies Islands, is not found to the writer's knowledge, in the Mangrove swamps of the Island at the present day.

The three common West Indies Mangrove trees are common to both the Old and the New World. They were doubtless dispersed from Tropical Africa by ocean currents which carried the fruits across the South Atlantic ocean.

(*To be Continued*).